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# THE RELATIONSHIP BETWEEN TAXES AND GROWTH AT THE STATE LEVEL: NEW EVIDENCE

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*The effects of state tax policy on economic growth, entrepreneurship, and employment remain controversial. Using a framework that in prior research generated significant, negative, and robust effects of taxes on growth, we find that neither tax revenues nor top income tax rates bear stable relationships to economic growth or employment across states and over time. While the rate of firm formation is negatively affected by top income tax rates, the effects are small in economic terms. Our results are inconsistent with the view that cuts in top state income tax rates will automatically or necessarily generate growth.*

*Keywords: state taxes, state economic growth, firm formation, tax cuts*

*JEL Code: H71*

## I. INTRODUCTION

The effects of state-level tax policy on states' economic growth and on related activity such as entrepreneurship and employment have proven to be perennial, controversial issues in academic and policy circles. Policy controversies have heated up in recent years as several states, hoping to stimulate long-term growth and new business activity, have cut taxes in various ways as their budgets have recovered following the Great Recession. Most prominently, Kansas cut taxes in 2012, eliminating its top income tax bracket, reducing other income tax rates, and abolishing state income taxation of pass-through entities. Several other states have enacted or proposed lower income taxes, sometimes in exchange for higher sales tax revenue. In contrast, some states, most notably California and New York, have maintained higher top marginal income tax rates that were originally introduced to address revenue shortfalls (Bosman, 2015).

A voluminous academic literature on taxes and state growth features widely varying methodologies and results. Major recent studies reach almost every conceivable finding: tax cuts raise, reduce, do not affect, or have no clear effect on growth. The effects of

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different taxes — income, corporate, property, and sales — vary dramatically within and across studies. Several factors complicate interpretation of the findings; the studies use different dependent variables, analyze different time periods, employ alternative measures of tax revenues and/or rates, include different measures of government spending, control for different independent variables, and use different control groups and identification methods. Additionally, state balanced budget requirements imply that revenues and spending should co-vary closely, making it more difficult to study independent influences of taxes or spending.

In this paper, we present new results on how state tax policy affects economic growth and entrepreneurial activity. Using a framework that in prior work generated significant, negative, and robust effects of taxes on income growth, we nonetheless find that neither tax revenues nor top marginal income tax rates bear any stable relationship – and, indeed, often bear a positive relationship – to economic growth rates across states and over time. Consistent with these findings, we also find that tax revenues have unstable effects on employment over time and that marginal tax rates do not affect employment levels. While the rate of firm formation is negatively affected by top income tax rates, the effects are small in economic terms.

Because there are so many specifications already in the literature, our goal was to build on a previously existing model. In particular, we extend the model in Reed (2008), who uses five-year observations and consistently finds that tax revenue levels negatively affect the growth rate of real per capita personal income during the 1970–1999 timeframe under a wide range of specifications. Our goal is not to replicate Reed's results, though we do generate similar findings for a similar time period. Rather, the advantage of using this approach is that we can examine the robustness of results as the time period is updated or other specification details are altered. The disadvantage is that the identification method is not as strong as studies that compare the economic activity of neighboring areas located on opposite sides of a state line.

We essentially replicate Reed's original findings, using data from 1977 to 2001. We show, however, that the results are not robust to several extensions. First, simply extending the sample period by one five-year observation to 2006 (or two, to 2011, and thus including the Great Recession) greatly reduces the absolute value of the effects and eliminates their statistical significance. Given the sensitivity of the results to time period, our second extension is to test for parameter stability over 1977–2006. We find that the estimated impact of tax revenues on income growth changes sign over the first and second 15 years of the sample period. The effect is negative over the 1977–1991 period and positive over the 1992–2006 period.

Our third extension decomposes tax revenues into components. We show that different taxes have dramatically different impacts on growth, with property taxes exerting consistently negative effects and income and corporate taxes usually exerting positive effects. Statistical tests overwhelmingly confirm that it is inappropriate to aggregate the components of tax revenue into a single aggregate revenue measure.

We extend Reed's results in a fourth way, by including estimates of the top statutory state income tax rate and the top effective state income tax rate, that is, the top statutory rate adjusted for federal deductibility of state taxes. Inclusion of these variables

does not change the results for tax revenues noted above, and generally the tax rate variables do not affect growth. All of our findings described above remain in place when we add controls for public spending categories and a variety of economic, social, and political variables.

To explore these effects further, we look at two main components of economic growth: firm formation and employment. We show that neither variable is consistently affected by tax revenue levels. Top marginal income tax rates have no effect on employment, but appear to reduce firm formation slightly. Raising the top income tax rate by 1 percentage point reduces the rate of firm formation by about 0.1 percent per year.

Section II reviews previous literature. Section III describes our methodology and data. Section IV examines the impact of taxes on real growth of personal income. Section V examines the impact on firm formation and employment. Section VI contains our concluding remarks.

## II. PREVIOUS RESEARCH

There is a very large literature on the issues examined in this paper. Mazerov (2013) and McBride (2012) provide a lengthy list of relevant citations. Although an exhaustive review of the literature is beyond the scope of this paper, we discuss several notable papers below.

Perhaps the most convincing approach to studying the effects of state tax policy identifies tax effects by comparing neighboring areas that differ in tax policy because they lie on opposite sides of a state border. This approach helps to control for the fact that neighboring areas may be similar in a variety of ways such as climate, culture, distance to ports, etc., some of which may not be observable or measurable in an econometric study. We have found four such studies: three find negligible impacts of taxes on growth, while one suggests significant effects of corporate taxes in some circumstances.

Reed and Rogers (2004) examine the effects of the 30 percent reduction in New Jersey's personal income taxes from 1994 to 1996. Using county-level data on employment, they show that New Jersey counties experienced strong employment growth after the tax cut, but so did counties in neighboring states that did not have tax cuts. The net effect of the tax cut, measured by the increase in employment in New Jersey counties relative to counties in neighboring states, was small and not significantly different from zero.

Holcombe and Lacombe (2004) examine growth in neighboring counties across state lines from 1960–1990. They compare per capita income growth in each border county in the lower 48 states to growth in the adjacent counties in neighboring states, controlling for the average state tax rate, the highest state marginal income tax rate, and other factors. The results require careful interpretation. Holcombe and Lacombe (2004, p. 292) report that "states that raised their income tax rates more than their neighbors had slower income growth and, on average, a 3.4 percent reduction in per capita income" from what would have otherwise occurred between 1960 and 1990. This gives the impression that the effects of state taxes are quite large. However, careful inspection indicates the results imply that a *massive* increase — 13.25 percentage points — in the highest state marginal tax rate would reduce per capita income after 30 years by about

$377 (in 1990 dollars) (Holcombe and Lacombe, 2004). Given that per capita income was $1,369 in 1960 and $11,048 in 1990 (all nominal), this implies that a 13.25 percentage point increase in the top state marginal tax rate would reduce the growth rate of nominal per capita income in the state by 0.13 percentage points, to 7.08 percent from 7.21 percent. If one can interpolate linearly, the results imply that raising the top state tax rate by 1 percentage point would have a negligible impact, reducing reduce the growth rate by just 0.01 percentage points annually.

Goff, Lebedinsky, and Lile (2012, p. 295) match "neighboring" pairs of states based on either location or, for states in the middle two quartiles of the respective distributions, population or land size ratio. They examine the effects of tax revenues on per capita Gross State Product (GSP) growth from 1997 to 2005. The authors show that the paired analysis — i.e., using matched pairs — provides roughly double the explanatory power of a standard cross-sectional regression**.** In the paired analysis, they show that a 1 percentage point higher tax burden (defined as revenue divided by GSP) reduces cumulative nominal GSP per capita growth from 1997 to 2005 by about 2 percentage points (the estimates range from 1.90 to 2.19). Given that average cumulative nominal GSP per capita growth over this period was 40 percent, their finding implies that a 1 percentage point higher state tax burden reduces the annual growth rate of nominal income by 0.19 percentage points, to 4.11 percent from 4.30 percent.

However, this result is not robust with respect to splitting tax revenues into its components. When the authors use income tax and corporate tax revenues as separate variables rather than overall revenues, they find that corporate taxes do not have a statistically significant impact on growth and that the marginal impact of higher individual income tax burdens is only about 20 percent of the impact of overall revenues. This implies that a 1 percentage point increase in income tax revenues as a share of GSP would reduce annual growth by only about 0.04 percentage points, a negligible effect.

Ljungqvist and Smolyansky (2014) employ a similar strategy of looking at counties across state lines, but do so with respect to changes in the statutory state corporate tax rate over the 1970–2010 period. They find that increases in statutory corporate tax rates reduce employment and wages, but reductions in statutory corporate tax rates do not raise employment and wages, except during recessions. Many corporate decisions, however, depend on effective tax rates rather than statutory rates. Effective rates depend on the tax base, which varies enormously across states, as well as the rate structure. The authors do not explore the effects of other components of the corporate tax system, such as depreciation deductions or changes in formulary apportionment rules.

Other research in the literature also reaches conflicting conclusions. In the most comprehensive paper, Alm and Rogers (2011) conduct an exhaustive sensitivity analysis of specifications that examine the impact of a wide variety of variables on growth. They obtain decidedly mixed effects. They study annual growth of real per capita income in the lower 48 states from 1947 through 1997, the longest time frame in the literature. Rather than using state fixed effects, which may have less value under a long time frame than a short one, they use, in various regressions, combinations of more than 130 explanatory variables lagged by one period and grouped into categories of revenues, expenditures, demographics, geography, and national. Alm and Rogers (2011, p. 9) find that the esti-

mated effects of overall tax revenues on growth are "quite sensitive" and depend on the inclusion of other variables as explanatory factors, the time period employed, and other aspects of the specification. The effects of revenues from the corporate income tax and personal income tax separately are also sensitive to specification, but when they are significant, they are often positive, suggesting that higher taxes and greater reliance on these specific taxes compared to others are associated with faster growth. The authors conclude that the overall estimated effects of taxes are fragile and that the causes of growth may vary across states. They also find that the political orientation of a state matters, with typically conservative states experiencing lower growth rates.

Several other studies are worth noting here. Tomljanovich (2004) uses data from 1972 to 1998 to show that higher taxes reduce short-term growth rates. Higher taxes do not affect the long-term growth rate, but the short-term reduction in growth rates permanently reduces the size of the economy. Decomposing total tax burden, Tomljanovich finds that income, property, and sales taxes have no significant effects, and corporate taxes have positive effects on growth. Ojede and Yamarik (2012) obtain the opposite results for overall tax burdens; the overall tax burden does not affect short-term growth but does affect long-term growth. Decomposing tax burdens, they find that sales and property taxes reduce growth, but corporate and income taxes do not.

Bania, Gray, and Stone (2007, p. 193) analyze "growth hills," arguing that the relation between growth and taxes should be quadratic and depend on spending. They find a positive linear effect and a negative quadratic effect of revenues on growth, with the growth effect hitting zero when revenues reach about 29 percent of personal income, far higher than revenues in most states.

Several studies look at the effects of taxes on growth and employment levels, and obtain mixed results. Using data from 1969 to 1986, Mullen and Williams (1994) find that, given overall tax levels, higher marginal tax rates reduce growth. Wasylenko and McGuire (1985) generally find that higher levels of overall taxation discourage employment growth. Effective income tax rates are shown to have a negative impact on employment growth in the wholesale, retail, and finance industries. However, their corporate tax rate variable does not yield statistically significant results. Goss and Philips (1994) find that personal income taxes reduce employment growth, but corporate taxes do not. Shuai and Chmura (2013) find that higher corporate taxes reduce employment growth. Gius and Frese (2002) find that lower personal income taxes raise the number of firms in a location, but corporate taxes do not have a significant impact.

Goolsbee and Maydew (2000) find that increased reliance on a single sales factor formula in corporate taxes, which results in reduced taxation based on payroll, caused an increase in manufacturing employment over the 1978–1994 period. A recent study by Merriman (2015), however, finds statistical concerns with the study, concluding that the results are not robust to an extension of the sample through 2010 or to the use of preferred statistical techniques, including clustering of errors at the state level.

Additional studies examine the role of taxes in the formation of firms; see Gale and Brown (2013) for further discussion. Bruce (2000) defines the tax rate differential as the tax rate an individual would face in a wage and salary position minus the one faced in self-employment. He finds that self-employment falls with higher average tax rates in

the self-employed sector but rises with higher marginal tax rates in the self-employed sector. While the direction of the marginal tax rate effect may seem counterintuitive, it is consistent with a view that people move to self-employment in part because business ownership provides opportunities to avoid or evade taxes. Gentry and Hubbard (2000, 2005) find that increased progressivity — that is, increased convexity of the tax schedule, including higher marginal tax rates — reduces entry into self-employment.

If the sheer fragility of the results in the literature is not evident from the survey above, it is demonstrated forcefully and systematically in a remarkable study by Pjesky (2006). Pjesky reviews five previous studies that generally show that taxes reduce state growth and economic activity: Vedder (1996), Becsi (1996), Helms (1985), Mofidi and Stone (1990), and Carroll and Wasylenko (1994). Pjesky first essentially replicates each of the studies, using data collected independently. He then re-estimates all of the studies over the same time period (1977–1997) and finds that about two-thirds of the relevant coefficients (on tax variables) change sign. Then, he re-estimates the studies using a common time period and a common dependent variable (per capita personal income) and finds a majority of the estimated effects of taxes on growth are positive, with many being significant. This demonstrates that the earlier results are not robust to straightforward extensions and sensitivity analysis.

Against this backdrop of contradictory and unstable results, Reed (2008) enters the fray and finds strong, negative, and robust effects of state taxes on growth. Reed regresses state-level data on the change in the log of real per capita personal income between the current year, $t$, and 4 years earlier, $t-4$, on the change in overall tax revenues (as a share of personal income) over the same period, and on overall tax revenues (as a share of personal income) in $t-4$ for six five-year periods from 1970 to 1999 (1970–1974, 1975–1979, etc.). Notably, he finds strong, negative impacts of overall tax revenues on per capita income growth across a wide variety of specifications, including splitting the sample by time period and by geographic area, adding an extensive list of government spending and control variables, altering the time periods involved, and estimating both structural and reduced form versions of the model. Because our specification developed below builds on the Reed (2008) model, we defer further discussion of his framework to the next section.

## III. METHODOLOGY

### A. Specification

Based on the formulation in Reed (2008), we estimate

$$(1)\quad DLNY_{it} = \beta_0 + \beta_1(DTTAX_{it}) + \beta_2(TTAX_{i(t-4)}) + \beta_3(DX_{it}) + \beta_4(X_{i(t-4)}) + state_i + time_t + \varepsilon_{it},$$

where the $\beta$'s are coefficients, $t$ indexes years, $i$ indexes states, $D$ represents the change in a variable between periods $t-4$ and $t$, $LNY$ is the log of real personal income per capita,

*TTAX* is total tax revenue as a share of personal income, *X* is a vector of other explanatory variables, *state* captures fixed effects, and *time* is a vector of five-year periods.

Reed develops a structural model based on theory. He estimates a structural model, which includes measures of capital and labor at the state level, as well as a reduced form version. Our specification in (1) is essentially the reduced form version. Reed discusses several virtues of this specification. Annual revenue data are susceptible to measurement error, and five-year periods are long enough to mitigate the biases created. Serial correlation and measurement errors are plausibly less severe when observations are spread out over time. The periods are non-overlapping (1970–1974, 1975–1979, etc.). Having the year intervals overlap would induce spurious positive correlation across time periods. Having the year intervals connect would induce spurious negative correlation between time periods. Including both contemporaneous and lagged effects of the dependent variables, along with state and time effects, allow for a variety of channels through which taxes can affect growth, including effects that take time to materialize. The panel specification allows controls for state fixed effects.

We use panel data for the 48 contiguous states for the period 1977–2011. The sample period is chosen with regard to U.S. Census data limitations on revenues and business dynamics. We estimate (1) with ordinary least squares (OLS) using five-year, non-connecting intervals (for example, 1977–1981, 1982–1986, and so on through 2007–2011). We weight each state's observations by its average population from 1977–2011, using data from the U.S. Census annual July 1 estimates (U.S. Census Bureau, 2012). Similar to the OLS analyses in Reed (2008), we employ robust standard errors to correct for heteroscedasticity. Standard errors are not clustered by group.

### B. Dependent Variables

Following Reed (2008), our first specification examines the change in the natural log of real personal income per capita from $t - 4$ to $t$ for each state. This variable is calculated starting with data on nominal personal income by state from the Bureau of Economic Analysis's Regional Database (Bureau of Economic Analysis, 2014b). The nominal data are then converted to a real measure that is chained to 2011 dollars and divided by the respective state's population in the relevant year. The resulting measure is logged and differenced (and multiplied by 100 to simplify interpretation).

To measure business activity, we use 1977–2011 data on the change from $t - 4$ to $t$ in the logged number of firms per capita, with the gross firm data taken from the September 2014 release of the U.S. Census Business Dynamics Statistics (BDS) database (U.S. Census Bureau, 2014b).[1] Hathaway and Litan (2014) use the same data from an earlier release. We also estimated effects for the number of establishments using the

[1] BDS classifies a firm as a "business organization consisting of one or more domestic establishments that were specified under common ownership or control," and an establishment as "a single physical location where business is conducted or where services or industrial operations are performed." The number of firms and establishments are both one for single-establishment firms (U.S. Census Bureau, 2014a.)

same data source, but the firm formation and establishment series are so highly correlated (99 percent) that the results were virtually identical and are not reported below.

To measure employment, we specifically examine the change in the logged employment-population ratio. This variable is preferred over the number of employees since the number of employees in a state can be affected by population growth. The employment-population measure is listed in the Bureau of Labor Statistics Local Area Unemployment Statistics database as the annual average proportion of the civilian, age 16 and over, non-institutional population that is employed (Bureau of Labor Statistics, 2015).

### C. Explanatory Variables

Our principal explanatory variable is total state and local tax revenue in a given state and year as a share of personal income. The variable is taken from the Urban-Brookings Tax Policy Center's State and Local Finance Data Query System (SLF-DQS), which houses state revenue and expenditure data originating from the U.S. Census Government Finance Statistics (GFS) database (Tax Policy Center, 2013).[2] When local data are included in the request, there are missing values for the years 2001 and 2003. To address this issue, we simply use the averages of the preceding and following years. For example, values for 2001 are imputed as the average of 2000 and 2002 values. Total tax revenue is distinguished from total revenue, as the latter includes inter-governmental transfers.

We use two alternative measures of state income tax rates. The first is the top *statutory* marginal personal income tax rate (Tax Policy Center, 2015; Poterba and Rueben, 2001). We were unable to code a statutory rate for Nebraska until 1987, Rhode Island until 2000, and Vermont until 2000. These states employed tax features that make it difficult to enumerate a single value for the maximum personal rate. For example, a state might tax its citizens at a certain percentage of federal liabilities. We exclude these year-state observations when analyzing marginal tax rates.

The second formulation of state income tax taxes reports the top *adjusted* marginal personal income tax rate (SADJ), which we define as the difference between the combined federal and state income tax rate for an itemizer facing the top federal rate and the federal tax rate that filer faces. The combined rate is $(1 - S)F + S$, where $S$ is the state rate and $F$ is the federal rate. The adjusted tax rate is given by

$$(2) \quad SADJ_{it} = (1 - S_{it})F_t + S_{it} - F_t = S_{it}(1 - F_t).$$

In certain specifications, we add a dummy variable that indicates whether the time period is 1992 or later. This variable is never entered on a stand-alone basis, since time effects are already included; rather, it is interacted with the tax revenue of the tax rate variables in order to see if the impact of tax policy varies over time.

To control for how revenues are used, we include measures of spending. Our measure of productive physical investment spending combines total state and local airport,

[2] This is series R05 from the SLF-DQS.

highway, and transit utility spending as a share of personal income.[3] Our proxy for social spending is the sum of state and local direct expenditures on public welfare, unemployment compensation, and other insurance trust expenditures as a share of personal income.[4] These expenditure data, similar to the revenue variables, have underlying missing values for 2001 and 2003 for local data. To compensate, we employ the same averaging procedure as described above. The omitted component of spending may be thought of largely as government operations and education.

Other control variables include the unemployment rate and population density. In its basic form, the unemployment rate is listed as the January seasonally-adjusted unemployment rate from 1977–2011 for a given year and state. Figures are extracted from the Bureau of Labor Statistics Local Area Unemployment database (Bureau of Labor Statistics, 2015). Population density is calculated as the average population per square mile of land (U.S. Census Bureau, 2012).

We also use four different sets of political or institutional dummy variables. The first indicates whether a state's governor is Republican for the majority of the year. Historical governor data were obtained from the National Governors Association (2014). Two additional variable sets indicate party control of the state legislatures. Since every state except Nebraska has a bicameral legislature, we use one dummy variable for a unified Republican legislature and one dummy variable for a unified Democratic legislature. If both dummy variables are zero, a state has a divided legislature. We omit Nebraska's data because the state's unicameral members are non-partisan. For 1977-2008, we use data from Dubin (2007), where he outlines the partisan breakdown of each legislature following every election. Since most elections occur every other November, we carry each value over to the following two years. For example, data presented for 2004 are included in the 2005 and 2006 observations. For 2009–2011 we use the party controls reported by the National Conference of State Legislatures (2014). We also include a dummy variable set that indicates whether a state has a tax or expenditure limitation (TEL) in place during a given year (National Association of State Budget Officers, 2015). Since these are binary variables, we only include the current year's value and the four-period lagged value. There is no "change variable" as there is for the other variables.

## IV. RESULTS FOR PERSONAL INCOME

The first set of columns in Table 1 summarizes the effects of tax revenue on personal income growth. The specification used is (1), with no $X$ variables. The regressions include a constant, the change in tax revenue, lagged tax revenue, and state and time fixed effects, and are weighted by state population. The regression reported in the first column shows that our estimates basically replicate Reed (2008) for the effects of taxes on real per capita personal income. For 1977–2001, the coefficient on the change in tax

[3] These are series E020, E065, and E130 from the SLF-DQS, respectively.

[4] These are series E090, E137, and E138 from the SLF-DQS, respectively.

revenues over the last four years is –1.96 (p = 0.019) and the coefficient on four-year lagged tax revenues is –1.36 (p = 0.052).[5]

These findings are similar to those of Reed (2008, Table 1), who obtained statistically significant estimates of –2.6 and –1.6, respectively, on the four-year change and the level of tax revenues four years earlier. His sample period covers 1970 to 1999. Our estimates imply that for every percentage point of personal income taken as tax revenue four years ago, the cumulative growth of real per capita income over the ensuing four years was reduced by 1.36 percent, or about 0.34 percent per year. For every percentage point of personal income by which tax revenue rose over the previous four years, real per capita income was reduced by 1.96 percent, or about 0.5 percent per year. These are economically significant and substantial effects.[6]

As mentioned above, Reed (2008) shows the results to be robust to a wide variety of changes. Our first specification test is to extend the sample period. As shown in the second column of Table 1, the results are not robust to extending the sample period to 2006. The change-in-taxes and lagged-taxes variables have negative effects, but they are much smaller than in the first column and not statistically significant. Extending the sample to 2011 (see the results in the third column) generates similarly small and insignificant effects.

The sensitivity of the results raises the possibility that the coefficient estimates are not stable over time. To test this, we use the same specification as in Table 1 but focus on the 1977–2006 period, add a dummy variable that equals one if the observation is in the second half of that period (1992–2006), and interact the dummy with the two tax revenue variables. The first column of Table 2 shows that the estimated net effect of the tax variables on growth is negative for the 1977–1991 period (with coefficients of –2.30 on the change in revenues and –1.27 on four-year lagged revenues). But the point estimate of the change in revenues variable is *positive* in the 1992–2006 period (–2.30 + 3.09) and is significantly different from the effect estimated for 1977–1991. These results stand in sharp contrast to the robustness shown for the sample splits in the 1970–1999 period reported by Reed (2008).

The aggregate tax revenue variable that we, Reed (2008), and many others have used is the sum of revenues from different taxes and thus implicitly constrains each revenue source to have the same effect on growth. Different taxes, however, may have different

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[5] Estimates that exclude state fixed effects are weaker but still attain significant negative effects. Estimates that exclude time effects, however, generate a positive coefficient on the change in revenues over the previous four years, perhaps because the regression is picking up the fact that revenues as a share of income are pro-cyclical because of automatic stabilizers, rather than because of anything having to do with the effects of taxes on growth.

[6] The result are robust to a variety of specifications (not shown), including (1) using 2000 data instead of 2001 to avoid having to impute local government data for 2001; (2) not weighting the regressions by population; (3) lagging the revenue variables by one year to address the potential endogeneity of the change in revenues (recall also that all of the regressions include time effects); (4) examining data with two-year lags; (5) excluding all data for states with any missing data; (6) estimating separate effects for increases versus decreases in tax revenues; (7) estimating non-linear effects of revenues; (8) controlling for tax rates and revenues in neighboring states; and (9) adding a dummy for the presence of a TEL and interacting that dummy with lagged revenues and the change in revenues.

**Table 1**

Per Capita Real Personal Income Growth

| Sample Period | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 |
|---|---|---|---|---|---|---|---|---|---|
| Change in tax revenues | –1.96** | –0.95 | –0.55 | –2.05** | –0.98 | –0.57 | –2.12** | –1.01 | –0.54 |
| | (0.83) | (0.65) | (0.60) | (0.82) | (0.65) | (0.62) | (0.84) | (0.66) | (0.63) |
| Tax revenues ($t-4$) | –1.36* | –0.82 | –0.78 | –1.51** | –0.80 | –0.72 | –1.44** | –0.84 | –0.75 |
| | (0.70) | (0.62) | (0.59) | (0.68) | (0.64) | (0.62) | (0.68) | (0.64) | (0.63) |
| Change in MTR | NA | NA | NA | 0.14 | 0.24 | 0.14 | NA | NA | NA |
| | | | | (0.32) | (0.30) | (0.26) | | | |
| MTR ($t-4$) | NA | NA | NA | 0.14 | –0.02 | –0.08 | NA | NA | NA |
| | | | | (0.29) | (0.25) | (0.22) | | | |
| Change in adjusted MTR | NA | NA | NA | NA | NA | NA | 0.20 | 0.37 | 0.15 |
| | | | | | | | (0.68) | (0.63) | (0.54) |
| Adjusted MTR ($t-4$) | NA | NA | NA | NA | NA | NA | 0.34 | 0.04 | –0.17 |
| | | | | | | | (0.66) | (0.60) | (0.54) |
| Adjusted $R^2$ | 0.63 | 0.59 | 0.66 | 0.62 | 0.59 | 0.65 | 0.62 | 0.59 | 0.65 |
| N | 240 | 288 | 336 | 228 | 276 | 324 | 228 | 276 | 324 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are included in parentheses.

**Table 2**
Per Capita Real Personal Income Growth — Time Varying Effects

| Sample Period | 1977–2006 | 1977–2006 | 1977–2006 |
|---|---|---|---|
| Change in tax revenues | –2.30*** | –2.32*** | –2.41*** |
| | (0.73) | (0.73) | (0.74) |
| Tax revenues ($t-4$) | –1.27** | –1.18* | –1.30** |
| | (0.58) | (0.61) | (0.61) |
| Change in tax revenues × (1992–2006) | 3.09*** | 2.84*** | 2.82*** |
| | (1.04) | (1.07) | (1.08) |
| Tax revenues ($t-4$) × (1992–2006) | –0.12 | –0.30 | –0.18 |
| | (0.46) | (0.44) | (0.47) |
| Change in MTR | NA | 0.01 | NA |
| | | (0.35) | |
| MTR ($t-4$) | NA | –0.10 | NA |
| | | (0.23) | |
| Change in MTR × (1992–2006) | NA | 0.38 | NA |
| | | (0.70) | |
| MTR ($t-4$) × (1992–2006) | NA | 0.09 | NA |
| | | (0.21) | |
| Change in adjusted MTR | NA | NA | –0.15 |
| | | | (0.75) |
| Adjusted MTR ($t-4$) | NA | NA | 0.06 |
| | | | (0.61) |
| Change in adjusted MTR × (1992–2006) | NA | NA | 0.98 |
| | | | (1.15) |
| Adjusted MTR ($t-4$) × (1992–2006) | NA | NA | 0.14 |
| | | | (0.36) |
| Adjusted $R^2$ | 0.61 | 0.60 | 0.60 |
| N | 288 | 276 | 276 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are in parentheses.

effects on growth. To test this, we decompose tax revenues into five categories (personal income, corporate income, sales, property, and other).[7] The first column of Table 3 shows that the effects of taxes on growth vary dramatically across revenue sources for 1977–2006 (similar results hold for 1977–2001 and for 1977–2011). Property taxes enter strongly and negatively, while the change in corporate taxes enters strongly and positively, as do lagged income taxes.[8] F-tests strongly reject equality of the coefficients across tax sources (in either the lagged value or recent changes variable). This finding rejects the specification used by Reed (2008) and many others.

All of the specifications discussed above include tax revenue variables but omit marginal tax rate information. The second and third sets of columns in Tables 1, 2, and 3 show the effects of including the top statutory or the top adjusted tax rates in the regressions and demonstrate two main results. First, including the tax rate does not change the basic pattern of results discussed above for the tax revenue variables. Second, the effects of marginal tax rates on growth are close to zero, variable in sign, and not statistically significant.

In additional analyses, we add government spending variables for welfare and investment and the variety of explanatory variables described earlier. These extensions generally do not have much of an impact on the effects of the tax revenue or marginal tax rate variables. For example, Table 4 expands Table 1 to report the effects of both tax and spending variables, controlling for the other explanatory variables described above.[9] The major results shown earlier hold here as well. The sign and significance of the tax revenue coefficient is sensitive to time period, and marginal tax rate measures do not affect growth in any of the specifications. Regarding the government spending variables, welfare spending has a negative impact on growth in all of the specifications, while investment spending does not have significant effects.[10]

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[7] These are series R27, R28, R09, and R06 from the SLF-DQS, respectively. Other taxes are simply the total tax values less the four aforementioned series.

[8] The coefficients report the effect of an increase in the tax revenue equal to 1 percent of personal income. Because the different taxes raise different amounts of revenue, the 1 percent of personal income increases translate into very different percentage changes in each tax source. For example, corporate revenues have averaged about 0.4 percent of personal income over the sample, while personal income taxes averaged about 2 percent. Thus, if the corporate tax coefficient is 8.0, the results imply that a 10 percent increase in corporate taxes (from 0.40 to 0.44 percent of personal income) would raise the growth rate by 0.32 percentage points. Likewise, a 10 percent increase in income taxes (from 2.0 to 2.2 percent of personal income) would raise the cumulative growth rate by 0.40 percentage points if the income tax coefficient were 2.0.

[9] Given the balanced budget requirements that states impose on themselves and given the presence of government spending variables in the used to finance spending other than on welfare and investment. In contrast, the tax variables in Tables 1–3 show the effects of an increase in taxes that is used to finance an average of all types of government spending.

[10] We have also run regressions using real Gross State Product per capita as the dependent variable (Bureau of Economic Analysis, 2014b). GSP is a better measure of state-level activity compared to personal income, as it measures how much is produced in a given state in a given year, whereas personal income measures the total (state-originated and externally originated) income of residents and businesses in the state. But the method by which GSP figures are constructed changed so that the series up to 1997 and after 1997 are not comparable (Bureau of Economic Analysis, 2014a). As a result, we estimated GSP effects for 1977 to 1996 and 1997 to 2006 or 2011. Our results, not shown, find that tax revenues and marginal tax rates produce negative and insignificant effects of taxes on GSP through 1996 and positive and insignificant effects of taxes on growth from 1997 to 2006 or 2011.

**Table 3**
Per Capita Real Personal Income Growth — Tax Decomposition

| Sample Period | 1977–2006 | 1977–2006 | 1977–2006 |
|---|---|---|---|
| Change in income taxes | 1.94<br>(1.42) | 1.88<br>(1.56) | 1.86<br>(1.58) |
| Income taxes ($t-4$) | 1.76*<br>(0.90) | 1.79*<br>(1.05) | 1.76<br>(1.12) |
| Change in corporate taxes | 7.94***<br>(2.85) | 7.93**<br>(3.14) | 7.98***<br>(3.05) |
| Corporate taxes ($t-4$) | 1.27<br>(2.74) | 1.10<br>(2.94) | 1.10<br>(3.05) |
| Change in sales taxes | 0.33<br>(1.35) | 0.34<br>(1.38) | 0.34<br>(1.41) |
| Sales taxes ($t-4$) | –0.92<br>(1.17) | –0.94<br>(1.16) | –0.95<br>(1.21) |
| Change in property taxes | –4.38***<br>(0.90) | –4.37***<br>(0.92) | –4.37***<br>(0.93) |
| Property taxes ($t-4$) | –2.77***<br>(0.83) | –2.74***<br>(0.87) | –2.75***<br>(0.85) |
| Change in other taxes | 0.43<br>(1.52) | 0.46<br>(1.56) | 0.45<br>(1.54) |
| Other taxes ($t-4$) | –0.68<br>(1.59) | –0.68<br>(1.61) | –0.66<br>(1.61) |
| Change in MTR | NA | 0.09<br>(0.37) | NA |
| MTR ($t-4$) | NA | –0.004<br>(0.24) | NA |
| Change in adjusted MTR | NA | NA | 0.16<br>(0.66) |
| Adjusted MTR ($t-4$) | NA | NA | –0.003<br>(0.56) |
| Adjusted $R^2$ | 0.69 | 0.68 | 0.68 |
| N | 288 | 276 | 276 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are in parentheses.

**Table 4**

Per Capita Real Personal Income Growth — Full Set of Controls

| Sample Period | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 |
|---|---|---|---|---|---|---|---|---|---|
| Change in tax revenues | –1.13** | –0.55 | –0.07 | –1.09** | –0.53 | –0.005 | –1.35*** | –0.65 | –0.12 |
| | (0.55) | (0.48) | (0.46) | (0.52) | (0.48) | (0.45) | (0.52) | (0.48) | (0.46) |
| Tax revenues ($t-4$) | –0.99** | –0.60 | –0.17 | –0.88** | –0.37 | 0.08 | –1.10*** | –0.62 | –0.16 |
| | (0.46) | (0.45) | (0.44) | (0.43) | (0.44) | (0.44) | (0.41) | (0.43) | (0.43) |
| Change in MTR | NA | NA | NA | 0.21 | 0.25 | 0.01 | NA | NA | |
| | | | | (0.30) | (0.29) | (0.24) | | | |
| MTR ($t-4$) | NA | NA | NA | –0.09 | –0.20 | –0.21 | NA | NA | NA |
| | | | | (0.23) | (0.21) | (0.18) | | | |
| Change in adjusted MTR | NA | NA | NA | NA | NA | NA | 0.41 | 0.52 | 0.16 |
| | | | | | | | (0.47) | (0.48) | (0.44) |
| Adjusted MTR ($t-4$) | NA | NA | NA | NA | NA | NA | 0.39 | 0.09 | 0.08 |
| | | | | | | | (0.34) | (0.34) | (0.32) |
| Change in welfare spending | –1.14 | –0.15 | 0.12 | –1.20* | –0.31 | 0.06 | –0.97 | –0.14 | 0.15 |
| | (0.72) | (0.62) | (0.54) | (0.71) | (0.61) | (0.54) | (0.74) | (0.63) | (0.55) |
| Welfare spending ($t-4$) | –1.87*** | –1.12** | –0.97** | –1.90*** | –1.28** | –1.14** | –1.69*** | –1.09* | –0.96* |
| | (0.63) | (0.55) | (0.48) | (0.64) | (0.55) | (0.48) | (0.63) | (0.56) | (0.49) |

**Table 4, Per Capita Real Personal Income Growth — Full Set of Controls, Continued**

| Sample Period | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 |
|---|---|---|---|---|---|---|---|---|---|
| Change in investment spending | –0.23 | –0.17 | –0.28 | –0.19 | –0.32 | –0.50 | –0.16 | –0.15 | –0.30 |
| | (1.43) | (1.19) | (0.99) | (1.39) | (1.16) | (0.99) | (1.44) | (1.20) | (1.00) |
| Investment spending ($t-4$) | 0.13 | 0.32 | 0.48 | 0.22 | 0.27 | 0.37 | 0.31 | 0.40 | 0.50 |
| | (1.28) | (1.06) | (0.92) | (1.21) | (0.99) | (0.88) | (1.30) | (1.07) | (0.93) |
| Adjusted $R^2$ | 0.82 | 0.79 | 0.83 | 0.83 | 0.79 | 0.83 | 0.82 | 0.79 | 0.83 |
| N | 235 | 282 | 329 | 225 | 272 | 319 | 225 | 272 | 319 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are in parentheses. Though they are not listed in the table, these regressions include change in the unemployment rate, unemployment rate ($t-4$), change in population density, population density ($t-4$), Republican governor, Republican governor ($t-4$), Republican legislature, Republican legislature ($t-4$), Democratic legislature, Democratic legislature ($t-4$), TEL, and TEL ($t-4$).

## V. RESULTS FOR FIRM FORMATION AND EMPLOYMENT

Table 5 shows the effects of various fiscal variables on firm formation, with several interesting results. First, the effect of tax revenues on firm formation is similar to the effect of tax revenues on growth — negative and significant in the 1977–2001 period, but shrinking in absolute value and losing statistical significance as the sample period is extended to 2006 or 2011. Second, the estimated effects of marginal tax rates are mixed. In the regressions using the statutory marginal tax rate, the coefficient on the tax rate four years prior is negative and significant in two of the three specifications, but it suggests a very small effect. A 1 percentage point increase in the top income tax rate reduces firm growth by a cumulative 0.33 percent or 0.34 percent over four years, or by less than 0.1 percent per year. Moreover, the change in the statutory marginal tax rate has a *positive* and significant effect on firm formation over the 1977–2011 period. Thus, for that period, the combined effect of the current statutory marginal tax rate (the sum of the effect of the lagged rate and the change in rates, or –0.34 + 0.47) on firm formation is positive. In the regressions using the adjusted marginal tax rates, there is no significant effect of marginal tax rates from 1977–2001 (though the relationship with changing tax revenue remains negative). For 1977–2006 and 1977–2011, the lagged tax rate has negative and significant effects. With an average top federal tax rate over the period of 43 percent, the 0.80 coefficient for the 1977–2011 period implies that a 1 percentage point increase in a statutory state income tax rate would reduce firm formation by a cumulative 0.46 percent over four years, the equivalent of reducing the growth rate of firm formation by 0.11 percent per year.[11]

Table 6 shows the basic results for employment. The impact of tax revenues is negative but insignificant in each time period, with the magnitude of the impact being smaller in the samples that extend to 2006 and 2011. Likewise, adding marginal tax rates does not change the impact of revenues, and the tax rates themselves are not significantly related to employment.[12]

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[11] In regressions for firm formation that mirror the specification in Table 2, tax revenues had negative effects through 1991 but positive effects from 1992–2006, consistent with the way that tax revenue affected income growth over those periods. Marginal tax rate effects were small and negative throughout the time period. In regressions mirroring the specification in Table 3, income tax revenues generally have had positive effects on firm formation, while property taxes generally have had negative effects. The marginal tax rate effects continue to be negative but small.

[12] As with firm formation, we ran regressions for employment that mirror the right-hand-side specifications in Tables 2 and 3. In the analogue to Table 2, the change in tax revenues over the prior four years had a negative effect on employment in 1977–1991 but a positive effect in 1992–2006. Tax rates do not enter significantly in either period. In the analogue to Table 3, changes in income taxes positively affect employment, changes in property taxes negatively affect employment, and marginal tax rates do not affect employment.

**Table 5**

Firms Per Capita Formation Growth

| Sample Period | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 |
|---|---|---|---|---|---|---|---|---|---|
| Change in tax revenues | –2.14*** | –0.95 | –0.26 | –2.06*** | –0.89 | –0.31 | –1.99*** | –0.79 | –0.18 |
| | (0.56) | (0.62) | (0.59) | (0.56) | (0.61) | (0.54) | (0.56) | (0.58) | (0.51) |
| Tax revenues ($t-4$) | –0.61 | –0.26 | 0.07 | –0.40 | 0.06 | 0.40 | –0.54 | –0.11 | 0.28 |
| | (0.45) | (0.49) | (0.45) | (0.46) | (0.52) | (0.48) | (0.47) | (0.51) | (0.46) |
| Change in MTR | NA | NA | NA | 0.03 | 0.22 | 0.47* | NA | NA | NA |
| | | | | (0.22) | (0.24) | (0.28) | | | |
| MTR ($t-4$) | NA | NA | NA | –0.22 | –0.33** | –0.34*** | NA | NA | NA |
| | | | | (0.16) | (0.14) | (0.13) | | | |
| Change in adjusted MTR | NA | NA | NA | NA | NA | NA | 0.12 | 0.38 | 0.75 |
| | | | | | | | (0.43) | (0.51) | (0.53) |
| Adjusted MTR ($t-4$) | NA | NA | NA | NA | NA | NA | –0.49 | –0.76** | –0.80** |
| | | | | | | | (0.39) | (0.37) | (0.34) |
| Adjusted $R^2$ | 0.73 | 0.64 | 0.78 | 0.73 | 0.65 | 0.79 | 0.73 | 0.66 | 0.80 |
| N | 240 | 288 | 336 | 228 | 276 | 324 | 228 | 276 | 324 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are in parentheses.

**Table 6**

Employment-Population Ratio

| Sample Period | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 | 1977–2001 | 1977–2006 | 1977–2011 |
|---|---|---|---|---|---|---|---|---|---|
| Change in tax revenues | –0.96 | –0.49 | –0.24 | –0.97 | –0.49 | –0.29 | –0.89 | –0.41 | –0.19 |
| | (0.58) | (0.44) | (0.45) | (0.61) | (0.46) | (0.46) | (0.63) | (0.48) | (0.46) |
| Tax revenues ($t-4$) | –0.14 | 0.14 | –0.14 | –0.16 | 0.13 | –0.19 | –0.11 | 0.17 | –0.10 |
| | (0.49) | (0.42) | (0.42) | (0.53) | (0.45) | (0.45) | (0.52) | (0.45) | (0.44) |
| Change in MTR | NA | NA | NA | –0.12 | –0.07 | 0.09 | NA | NA | NA |
| | | | | (0.26) | (0.23) | (0.21) | | | |
| MTR ($t-4$) | NA | NA | NA | 0.01 | –0.01 | 0.05 | NA | NA | NA |
| | | | | (0.19) | (0.15) | (0.14) | | | |
| Change in adjusted MTR | NA | NA | NA | NA | NA | NA | –0.38 | –0.29 | –0.08 |
| | | | | | | | (0.56) | (0.46) | (0.40) |
| Adjusted MTR ($t-4$) | NA | NA | NA | NA | NA | NA | –0.16 | –0.19 | –0.20 |
| | | | | | | | (0.42) | (0.37) | (0.32) |
| Adjusted $R^2$ | 0.27 | 0.29 | 0.67 | 0.26 | 0.28 | 0.67 | 0.27 | 0.28 | 0.67 |
| N | 240 | 288 | 336 | 228 | 276 | 324 | 228 | 276 | 324 |

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Robust standard errors are in parentheses.

## VI. CONCLUSION

The effects of taxes on state-level growth have been the subject of continuing controversy, with many conflicting and fragile results in the literature. In this paper, we present new results for the impact of tax revenues, marginal tax rates, and other variables on overall real personal income growth, firm formation, and employment.

We build on the model constructed by Reed (2008), who shows that tax revenues negatively and significantly impacted growth of real personal income from 1970–1999. After replicating his results for a slightly different time period, we show that the results are not robust to an extension of the time period through 2006 or 2011, that the effect of tax revenues on personal income growth differed dramatically between the 1977–1991 period (when it was negative) and the 1992–2006 period (when it was non-negative and possibly positive), and that revenues from different taxes have different effects on personal income growth. These results undermine Reed's claim that there is a robust and consistent impact of tax revenues on personal income growth. We also show that including measures of the marginal tax rate do not affect the results for tax revenues and that marginal tax rates generally do not enter into the growth equations. Moreover, controls for government spending and other explanatory variables do not change any of these results. Consistent with these aggregate effects, we show that marginal tax rates generally have no impact on employment and statistically significant but economically small effects on the rate of firm formation.

Our results are not consistent with the view that cuts in top state income tax rates will automatically or necessarily generate significant impacts, or any impact, on growth. If anything, our study produces some evidence that property tax revenues are correlated with growth. Exploring that relationship, especially the connection between land values, property tax revenues, and growth, may well be worth additional research.

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## DISCLOSURES

The authors have no financial arrangements that might give rise to conflicts of interest with respect to the research reported in this paper.

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