Effects of State Sales Tax on GDP Per Capita: A Statewide Study for the United States

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Abstract

Economists have viewed the relationship between the impact of taxes on the GDP, however research dealing with the sales tax rate and the GDP have yet to be analyzed to the extent that income taxes have been investigated. In an effort to fill this void, we examine how the state sales tax rate across all fifty states within the United States impact the corresponding state's real GDP per capita. There will be a simple regression model along with additional multiple regressions to analyze the impact of the state sales tax rate on the state's economy. As a result of this investigation, the R-squared value increased dramatically from the initial simple regression to the last multiple regression model, as well as the statistical significance of certain explanatory variables, including the state sales tax rate.

I. Introduction

This project explores the effects of the state sales tax on the real GDP per capita by state within the United States. The overall goal is to apply statistical analysis and fundamental econometric methods to better understand underlying macroeconomic theory that involves the impact of certain variables on the economy (GDP). Moreover, macroeconomic theory dictates that GDP = C + I + G + X_n , where taxes is mentioned within the government component of the equation (G = Taxes - Transfers) and can lead to an overall impact on the economy. In addition, consumer spending is impacted by the purchasing power that an individual has, and if an individual possesses a smaller purchasing power, then the individual will likely spend less, which will lead to a smaller GDP. Sales tax influences this consumer purchasing power because when an individual chooses to purchase a good or service, part of their disposable income will be charged as a sales tax, which leads to a decrease in consumer purchasing power. This phenomenon is the goal of the research project, and also to view the underlying implications of such an instance on the domestic economy compartmentalized by states. Another aspect that needs to be considered, is the governmental component of the equation, which is encompassed in G in the fundamental macroeconomic equation. In addition, there may be two possibilities when dealing with the governmental component on the GDP per capita. One instance would be where taxes increase, which leads to greater expenditure by the government because they have more tax revenue to spend that leads to an increase in GDP. The second possibility occurs when the taxes increase, but the G component is overall decreased, which leads to a decrease in GDP. In addition to examining the state sales tax rate on the real GDP per capita, other explanatory variables that could potentially impact the state's GDP will also be included in subsequent multiple regression models, which will include factors such as: average local tax rate, unemployment rate, average credit score by state, and the number of Fortune 500 companies concentrated within a given state. This cross-sectional study will examine the most recent year where data is provided for each of these explanatory variables (2017) to view the effects in the modern economy, rather than focusing on older data. Overall, the effects of state sales tax on the GDP per capita for each state will be examined in further detail to extrapolate a relationship via empirical evidence along with additional explanatory variables.

The motivation behind this research project is to understand how sales tax can lead to a certain GDP per capita level. This project can aid state policy makers and other state officials that need to figure out a method to utilize taxes to ensure that they do not hinder the economy of their state. Furthermore, state sales tax can be applied to fiscal policy, in order to have an optimized effect on the economy, rather than focusing on a specified tax such as income tax. With understanding of how state sales tax impacts the economy, state and federal governments can apply harmonious tax policies, as a part of their fiscal policy in order to have desired results on the GDP. In studying the state sales tax rate, we provide further enrichment to the GDP formula via empirical evidence that can spur further investigations into different types of taxes, as well as provide valuable insight into the fundamental macroeconomic equation.

The hypothesis of this project looks at the relationship between the sales tax rate by state and the real GDP per capita by state. Furthermore, if an increase in a state sales tax rate occurs that will lead to consumers being taxed on the goods and services that they purchase, then this decreases the consumer's purchasing power. The decrease in purchasing power leads to less consumption in the macroeconomic equation ($GDP = C + I + G + X_N$), and a decrease in the overall GDP. In conjunction with this, if a decrease in a state sales tax rate occurs that will lead to consumers being taxed less on the goods and services that they purchase, which increases the consumer's purchasing power. The increase in purchasing power leads to more consumption in the macroeconomic equation, and an increase in the overall GDP. Another aspect of the macroeconomic equation that could impact the GDP per capita via a change in state sales tax rate, is the government component. An increase in state sales tax rate leads to an increase in tax revenue, which could result in an increase in government spending that would lead to an increase in the GDP, which could potentially offset the impact of consumption on the GDP. The alternative is that an increase in taxes could decrease G, which leads to a decrease in the GDP, which also could offset the consumption component impact on GDP.

II. Literature Review

When discussing the impact of taxes on the economy, most economists focus on the income tax, due to that being a focal point of fiscal policy during certain periods of the business cycle, such as recessions. Moreover, most research is focused on looking at varying models dealing with changes in the income tax, in order to examine results in the economy. More recently, economists have begun to further examine empirical evidence over a given time period to see the short-run as well as the long-run implications of changes in income taxes in the economy. Given the prolific research in this topic, it would be best to examine the effects of the income taxes on economic growth before exploring other tax forms such as the state sales tax rate, in order to better understand the behavior of taxes in the economy. The paper by Gale and Samwick (2017) delves deeper into the research of income taxes impact on economic growth. The paper explores the macroeconomic principles of reducing income taxes in the long-run, and the GDP over time. The research starts by viewing historical trends and past research, which confirms that income taxes do impact economic growth, with an inverse relationship i.e. income taxes go down, GDP goes up. Then, the paper further investigates the hypothesis by creating simulations that would look at tax cuts as well as tax increases by evaluating policies that countries have adopted over the years and used statistical analysis to view the empirical evidence to plot the data, in order to find trends. Moreover, the long-run suggests an alternate theory to income tax cuts and the GDP. The conclusion that the paper reaches is that tax cuts may raise economic growth if the incentives are such that they encourage spending. But, over time they may create effects such as a rise in the government deficit, which will reduce overall spending by the country, and raise interest rates, which ultimately lead to a slowed economy. This paper demonstrates the importance of incentives when dealing with taxes, and the need for individuals to spend rather than save when income taxes decrease. Our research positions itself as an examination of the state sales tax, which directly deals with consumption, and how the economy is impacted with differing sales tax rates and the real GDP per capita. In addition to understanding income taxes, it is important to verify further support for the impact of taxes on the economy, most importantly within the United States, where our observations are from. The research conducted by Mertens and Morten (2013) investigate the post-World War Two era of the United States, in order to study the impact of tax policy over time on different segments of the economic system, which include: monetary policy, labor market, and private expenditure components. The tax policy that is examined within this paper is personal and corporate tax rates over time, in order to view the dynamic impact it has on multiple segments of the economy. In addition, the paper investigates each of the previously mentioned segments of the economy to come to an overall conclusion that involves a four pronged closing remark. The most important of these concluding remarks deals with the fact that personal income tax cuts are effective in stimulating consumption in the short-run rather than corporate tax cuts, and the multiplier for spending is much greater than anticipated for the government. Mertens and Morten (2013) demonstrate that not every type of tax has a similar impact on the economy, and it is important to understand the segmented tax options to comprehend how the economy will react to a certain change in a given tax policy. In line with this idea, Auerbach and Gorodnichenko (2010) views the responses to output that occur due to fiscal policy, specifically during downturns and expansions in the economy. The overall result is the authors definitively decide how spending can impact the economy, yet, when it comes to the tax system, it is much more difficult because the effects of taxes do not include the different structural tax policies that exist. Meaning that different taxes have a different impact on the overall output, as previously mentioned by Mertens and Morten (2013). The paper ends with a remark on the fiscal multiplier, and the motivation for further investigation into the output changes that result due to fiscal policy. Auerbach and Gorodnichenko (2010) illustrate the behaviors of different taxes that are used in fiscal policy and the overall impact on output. This paper shows the importance of understanding the types of taxes that are available to policymakers, and the changes in output that may result when choosing a specific tax to target. With our research, we will not only look at the state sales tax rate, but also the average local tax rate to compare the impact of different types of tax rates on the real GDP per capita for every state. This comparison can be used to see other underlying factors that could potentially impact the economy of a given state. It is important to also understand what results past research have developed in understanding sales taxes or similar taxes such as consumption taxes because, as previously mentioned, research by Auerbach and Gorodnichenko (2010) and Mertens and Morten (2013) indicate that different taxes have different impacts on the economy. As a result, we study the paper by Milesi-Ferretti and Noriel (1998), which investigates the impact of consumption taxes, and income taxes on the growth of the economy and the income of individuals. The study looks into different reasons for how consumption taxes can lead to growth or slow downs in the economy, and the effect on the income that results with the action of consumption and/or income taxes. The paper also presents other rationale behind growth such as technological models and leisure models that are discussed with mathematical proofs and equations. Moreover, the conclusion that Milesi-Ferretti and Noriel come to with income taxes is that it is income-reducing, whereas consumption taxes could be income-reducing, but is dependent under the mathematical model at which it is looked at. Understanding whether consumption taxes have an impact on the income, is important because macroeconomic principle dictates that with an increase in income there will be a corresponding increase in economic growth. Classifying consumption taxes such as state sales tax rate as income-reducing can help aid our research by enhancing our comprehension of why states sales tax rates behave the way it does. Lastly, it is also important to analyze other explanatory variables that could impact economic growth, in order to avoid econometric violations such as omitted variable bias. Grier and Tullock (1989) look into the varying factors that influence economic growth in the post-War World Two era in 113 countries through a thirty year window. Moreover, the study looks into different types of countries that vary by developing and developed countries, and the research finds differences in reasons to why certain growth is impacted by a macroeconomic variable in the fundamental equation ($Y = C + I + G + X_n$) , and concludes that a specific macroeconomic variable impacts the growth of the nation. The main focus of the article is to look at government actions that lead to a change in the GDP of that specified nations. Additionally, the data suggests that growth of consumption is positively correlated with economic growth over the three decade span of time.The research indicates that depending on the country there may be different reasons as to why a specified country may experience growth whether it is fiscal policy, or other components of the economy like consumption. The paper illustrates the importance of looking into other explanatory variables in determining what influences the economic growth within a country. Our research will also look at other macroeconomic variables such as unemployment to see how much of the data can be explained with state sales tax rates, as well as the unemployment rate. Overall, these papers guide our own research in order to understand the behavior of taxes, as well as to add other explanatory variables in order to see which variables impact the real GDP per capita in different states.

Our contribution to the literature is to fill in the gaps that remain when dealing with taxes and GDP. The previous research papers look at various types of taxes most commonly income taxes, but others include corporate taxes, and consumption taxes. Only one study looked at consumption taxes, such as sales tax rates impact on the economic and income growth, but it does not look at the state-level, and focuses primarily on income growth over economic growth. While this data helps with overall trends, it does not look at the data meticulously enough to make conclusions based on the state-level, but only the national level. In this research, we are able to look at varying amounts of sales taxes across states, which is much more beneficial for state policymakers in making decisions and comparing them to other state authorities, to see if they are able to provide a sound economic policy to implement a balance between a sufficient GDP per capita level and sufficient sales tax revenues. This paper is meant to provide another aspect at looking at the continuous argument about taxes on the economy, in order to motivate further study that looks at the data from more of a comprehensive approach rather than a single variable approach.

III. Data

A. Source of Data

The data collected for this research is sourced from various entities. The state sales tax rate and the average local sales tax rate in each state were published by data.gov. Data.gov gathers datasets collected by the many federal agencies, as well as those produced by government agencies of states, into a single publicly accessible point. The explained variable, real GDP per capita, was published by the Bureau of Economic Analysis, which collects data and conducts research on various topics related to the economy. The unemployment rate for each state was found in a dataset compiled by the Bureau of Labor Statistics, an agency which tracks data related to employment and labor in the economy. The number of Fortune 500 companies in each state was released by Fortune Magazine. The credit agency Experian published the average consumer credit score for each state. There are fifty cases in our dataset, each with a corresponding data point for each variable.

B. Description of Variables

In this research, we sought to model the relationship between state sales tax rate (*statestr*), an explanatory variable, and real GDP per capita (*realgdppc*), the explained variable. As our objective is to model the relationship between sales tax rate and consumption, it seemed natural to use GDP, however, states with larger populations will likely and naturally have a larger GDP than less populous states. Therefore, we correct for this disparity by using real GDP per capita. A variety of explanatory variables were included in the regression to more accurately model the relationships between the explanatory variables and real GDP per capita.

Explanatory Variables

statestr

The state sales tax rate represents the rate at which sales tax is levied in a given state in 2017. As mentioned previously, we suspect a negative relationship between real GDP per capita and state sales tax. This variable is the primary independent variable in our research.

avglocaltr

This represents the weighted average of local sales tax in a state in 2017. Rarely is there only a sales tax at the state level; it is common for subordinate municipal governments (county, local, city) to establish their own sales tax applicable in their locality. Data.gov averages the various sub-state sales tax in a state and weights them by their respective populations to achieve a weighted average local sales tax. The local sales tax is expected to impact real GDP per capita in a similar manner as state sales tax, however the local sales tax changes independently of state sales tax, thus it was necessary to include this variable in the data.

unemployr

The unemployment rate represents the percentage of the labor force which is searching for a job in each state in 2017. Unemployed persons do not collect income and consume less than their employed peers; as the unemployment rate increases, more people are unemployed, consume less, and state real GDP per capita drops.

fortune500

Fortune500 indicates the number of Fortune 500 companies which are located within each state in 2017. Larger businesses contribute to a more stable economy in their area and state than smaller firms, providing greater income and job stability to its workers, who then spend such income because they have stability (Edmiston 2007). Using the Fortune 500 list as a proxy for firm size, we use this variable as a means of counting the number of large firms in a state.

avgcs

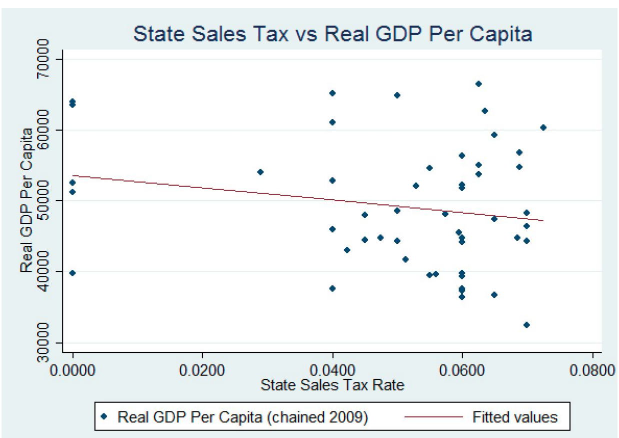
This variable represents the average consumer credit score in each state as reported by Experian in 2017. As consumers gain a higher credit score, they gain access to greater funding available to them by financial institutions. These funds allow them to consume, increasing real GDP per capita (Dudian 2012).

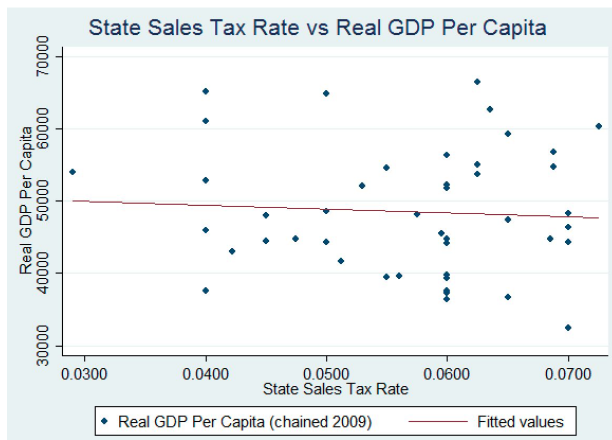
Table: Summary of Explanatory and Explained Variables

Variable	**Name**	**Source**	**Year**	**Description**
realgdppc	Real GDP Per Capita	Bureau of Economic Analysis	2017	The state GDP divided by the number of persons in the state
statestr	State Sales Tax Rate	Data.gov	2017	The rate at which goods, services are taxed by the state
avglocaltr	Average Local Sales Tax Rate	Data.gov	2017	The weighted average rate at which goods are taxed in a state's localities
unemployr	Unemployment Rate	Bureau of Labor Statistics	2017	The percentage of the labor force that is unemployed
fortune500	Number of Fortune 500 Companies	Fortune Magazine	2017	The number of Fortune 500 companies located in a state
avgcs	Average Consumer Credit Score	Experian	2017	The average credit score for consumers in each state

Table: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
realgdppc	50	49,141.88	8,848.06	32,447.00	66,500.00
statestr	50	0.05	0.02	0.00	0.07
avglocaltr	50	0.01	0.02	-0.00	0.05
unemployr	50	0.04	0.00	0.02	0.07
fortune500	50	9.96	13.57	0.00	58.00
avgcs	50	677.54	16.18	647.00	709.00





With the data collected, we examine the graphical relationship between the primary independent variable, state sales tax rate, and the dependent variable, real GDP per capita. The left scatter plot contains all fifty states and clearly shows a negative relationship between state sales tax and real GDP per capita. Five states, Alaska, Delaware, Montana, New Hampshire, Oregon, do not have any sales tax, compared to the lowest non-zero sales tax rate of 2.90%. We are curious to see the relationship between the primary independent variable and the dependent variable without these five states. The scatterplot on the right displays the results; there is a negative relationship between the two, but of the smallest degree, hardly a significant finding, but it may suggest the relationship between the two variables is weak.

C. Gauss-Markov Assumptions

1. Linear in Parameters: the models used in this research are simple and multiple regression models in the form $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$, which are linear in parameters.
2. Random Sampling: the dataset used to derive the models for this paper include all fifty states in the United States, thus no sampling was used and this assumption is satisfied.
3. No Perfect Collinearity: as indicated in the table below, no independent variable exhibits perfect collinearity with another independent variable.
4. Zero Conditional Mean: the expected value for the error term is zero (E(u)=0). We are able to test this assumption by averaging the residuals of the multiple regression model, which yields 0 and subsequently satisfies this assumption.
5. Homoscedasticity: the error term contains the same variance regardless of other independent variables. Using a STATA test for heteroscedasticity, we obtain a p-value of 0.95, allowing us to fail to reject the null of a constant variance for the error term, and, thus, satisfy the homoscedasticity assumption.

Table: Correlation Coefficients of Independent Variables

	State Sales Tax	**Average Local Sales Tax**	**Unemployment Rate**	**Number of Fortune 500 Companies**	**Average Credit Score**
State Sales Tax	1.00				
Average Local Sales Tax	-0.08	1.00			
Unemployment Rate	-0.03	0.17	1.00		
Number of Fortune 500 Companies	0.25	0.18	0.21	1.00	
Average Credit Score	0.09	-0.51	-0.28	-0.12	1.00

IV. Results

Simple Regression

Running a simple regression with real GDP and state tax rate as the dependent and independent variables respectively, utilizing data from all 50 states, the above analysis was seen, leading to the equation shown below

$$realgdppc = \beta_0 + \beta_1(\text{statestr}) + \text{u}$$

$$\widehat{realgdppc} = 53653.7 - 88449.67(statestr)$$

The R^2 value which was found to be 0.0392 suggesting that a state's sales tax has little correlation with the real GDP per capita, however the tiny bit of correlation that is present between the independent and dependent variable shows a negative impact supporting the hypothesis that there is an inverse relationship between states sale tax rate and real GDP per capita. More specifically, a unit increase in the state sales tax rate will lead to a decrease of $88,449.67 in that state's real GDP per capita. While the simple regression shows how real GDP per capita is affected by state sales tax, it does not consider other factors that could have an influence, such as the average local tax rates for each state, which will be included in the multiple regression analysis to better develop an equation analyzing the effects of sales tax on real GDP per capita. The intercept of the equation also shows that given a 0% state sales tax rate a real GDP per capita of $53,653.7 would occur.

As the fundamental reason behind this study is to examine the effects of state sales tax on real GDP per capita, another simple regression was ran in which 5 states (Alaska, Delaware, Montana, New Hampshire, Oregon) were excluded for lack of a state sales tax. This model is denoted by Model (1-o) below and follows the equation:

$$realgdppc = \beta_0 + \beta_1(\text{statestr}) + \text{u}$$

$$\widehat{realgdppc} = 51601.65 - 53401.07(statestr)$$

This suggests that given the states with a state sales tax rate, a unit increase in the state sales tax rate would lead to an expected decline of $53,401.07 in that states real GDP per capita. However, given a R^2 of 0.0041 and a t-value of -0.42 for β_1 this equation appears to be a very poor predictor of real GDP per capita based on state sales tax rate. For this reason, in future models, all states will be included in an effort to fully explain variations in real GDP per capita between states.

	State Sales Tax Rate	Intercept	Number of Obs	R-squared
Model (1-o) (standard error)	-53401.07 (126373.9)	51601.65*** (7279.84)	45	.0041

*significant at 10%; **significant at 5%; ***significant at 1%

Multiple Regression Model 1

After running and analyzing the simple regression, it was necessary to consider other variables that could possibly have an impact on real GDP per capita other than state sales tax rate. Within the scope and logic that the state sales tax rate and real GDP per capita would have an inverse relationship, including the average local sales tax rate into the regression makes sense to better discover the relation between real GDP per capita and sales tax at the state and local levels. Running the multiple regression using STATA software, again with data obtained from all 50 states, lead to the analysis above and the following equation.

$$realgdppc = \beta_0 + \beta_1(\text{statestr}) + \beta_2(\text{avglocaltr}) + \text{u}$$

$$\widehat{realgdppc} = 54376.99 - 91007.63(statestr) - 42814.31(avglocaltr)$$

Here there is a slight increase in the R^2 value increasing from 0.0392 in the simple regression to 0.0444 in the multiple regression, showing a slight improvement in the model. Similar to how state sales tax rate has a negative impact on real GDP per capita, average local sales tax also shows a negative impact towards real GDP per capita, although to a lesser extent. In this case, holding the average local tax rate constant a unit increase in the state sales tax will lead to a decline of $91,007.63 in that state's real GDP per capita. Holding the state sales tax rate constant, a unit increase in the average local tax rate will lead to a decline of $42,814.31 in the state's real GDP per capita. The intercept of the multiple regression equation suggests that given a 0% state sales tax rate along with a 0% local sales tax rate a real GDP per capita of $54,376.99 would be observed.

Multiple Regression Model 2

The second multiple regression model incorporates three more variables, those being unemployment rate, number of Fortune 500 companies and average credit score all by state. Savings rate is also a variable that would be beneficial to include in the model, however there was no obtainable data for savings rate on the state level. With the addition of these variables, the following equation was generated:

$$realgdppc = \beta_0 + \beta_1(\text{statestr}) + \beta_2(\text{avglocaltr}) + \beta_3(\text{unemployr}) + \beta_4(\text{fortune500}) + \beta_5(\text{avgcs}) + \text{u}$$

$$\widehat{realgdppc} = -12208.9 - 156966.2x_1 - 39663.96x_2 - 66610.56x_3 + 332.15x_4 + 102.08x_5$$

Holding all else constant, a unit increase in a state's sales tax rate will lead to a $156,966.2 decrease in real GDP per capita (a more substantial decrease than seen in the previous two models). A unit increase in the average local tax rate will lead to a $39,663.96 decrease in real GDP per capita holding all other variables constant. A $66,610.56 decrease will be seen in real GDP per capita following a unit increase in the unemployment rate of the state, holding other variables constant. An increase in real GDP per capita of $332.15 can be observed following a unit increase in the number of Fortune 500 companies in a state holding all other variables constant. An increase in real GDP per capita of $102.08 can also been observed following a unit increase in the average credit score of the state, holding all other variables constant. Each of the variables affects the real GDP per capita in its expected way as one would expect real GDP per capita to decrease with rises in taxes at the state and local level and rises in the unemployment rate, and real GDP per capita would increase with higher numbers of Fortune 500 companies and higher average credit scores in the state. The R^2 value showed a significant increase from the first multiple regression moving from a value of 0.0444 to 0.2924 a 558.56% increase, showing this regression model is an improvement from the first.

Statistical Inference:

In this section, we will determine if the explanatory variables are significant for each of the models that we ran regressions for, excluding Model 1-o. The significance levels that we will test the independent variables for the different models will be at 10%, 5%, and 1%. The null hypothesis for each of the explanatory variables will be, $H_0 : \beta = 0$, whereas the alternative hypothesis will be, $H_a : \beta \neq 0$.

Simple Regression (Model 1) Statistical Inference:

Table: Statistical Inference Values for Model 1

Independent Variables	**t**	**P > |t|**	**95% Conf. Interval**
statestr	-1.40	0.17	[-215512, 38612.65]
_cons	15.54	0.00	[46709.81, 60597.58]

For the simple regression model, we are only examining the state sales tax rate as an independent variable, the t-statistic was -1.40, and utilizing the t-distribution table for the degrees of freedom of 48 (n-k-1 = 50-1-1) we fail to reject the null at every significance level. In addition to looking at the critical values of the t-distribution, we also looked at the p-value, which demonstrates the lowest possible significance level we can reject the null hypothesis at, which came out to be 0.17 for the state sales tax rate, which further explains why we failed to reject the null hypothesis at the predetermined significance levels.

Multiple Regression (Model 2) Statistical Inference:

Table: Statistical Inference Values for Model 2

Independent Variables	t	P > |t|	95% Conf. Interval
statestr	-1.42	0.16	[-219535.5, 37520.25]
avglocaltr	-0.51	0.61	[-212565.8, 126937.2]
_cons	14.46	0.00	[46810.43, 61943.55]

In the second model, we included another explanatory variable, average local tax rate, which also needs to be tested for statistical significance. We test each of these two independent variables with the t-distribution table, with the degrees of freedom being 47 (n-k-1 = 50-2-1). The t-statistic came out to be -1.42 for the state sales tax, which is less than the critical value for each of the significance levels, therefore we fail to reject the null hypothesis at each predetermined significance level once again.

After determining the statistical significance of the state sales tax rate, we need to interpret the statistical significance of the average local tax rate. The t-statistic of -0.51 was not significant at any of the predetermined critical values, so we fail to reject the null for the average local tax rate as well.

Multiple Regression (Model 3) Statistical Inference:

Table: Statistical Inference Values for Model 3

Independent Variable	t	P > |t|	95% Conf. Interval
statestr	-2.65	0.01	[-276467.8, -37464.66]
avglocaltr	-0.45	0.66	[-217809.4,138481.5]
unemployr	-0.52	0.61	[-325669.9,192448.8]
fortune500	3.73	0.00	[152.62, 511.69]
avgcs	1.22	0.23	[-65.98, 270.14]
_cons	-0.21	0.84	[-129819.1, 105401.3]

The last model we looked at included all of the independent variables in this study, and each of these explanatory variables will be tested for statistical significance. The critical values were determined from the t-distribution table, with the degrees of freedom being 44 (n-k-1 = 50-5-1).

The state sales tax rate had a t-statistic of -2.65, which was significant at the 10% and the 5% level, but not at the 1% level, so we reject the null hypothesis, and accept the alternative hypothesis.

The average local tax rate had a t-statistic of -0.45, which was not significant at any of the predetermined significance levels because it was less than the corresponding critical values, so we fail to reject the null hypothesis.

The unemployment rate variable had a t-statistic of -0.52, which was not significant at any of the predetermined significant levels, so we fail to reject the null hypothesis.

The number of Fortune 500 companies by state variable had a t-statistic of 3.73, which is significant at every predetermined statistical level, so we reject the null hypothesis and accept the alternative hypothesis 0.

The average credit score by state variable had a t-statistic of 1.22, which was not significant at any of the predetermined statistical levels, therefore, we fail to reject the null hypothesis

The following summarizes our findings about the statistical significance of each of our variables in the three models we examined, where the standard errors are in parenthesis.

Table: Estimation Results

Dependent Variable: Real GDP Per Capita			
Independent Variables (standard errors)	**Model (1)**	**Model (2)**	**Model (3)**
State Sales Tax	-88449.67 (63195.13)	-91007.63 (63888.89)	-156966.2** (59295.16)
Average Local Sales Tax		-42814.31 (84380.43)	-39663.96 (88393.52)
Unemployment Rate			-66610.56 (128542.00)
Number of Fortune 500 Companies			332.15*** (89.08)
Average Credit Score			102.08 (83.39)
Intercept	53653.7*** (3453.58)	54376.99*** (3761.20)	-12208.9 (58356.72)
Number of observations	50	50	50
R-squared	0.04	0.04	0.29

*significant at 10%; **significant at 5%; ***significant at 1%

V. Extensions

Robustness Tests

The variables of the average local tax rate, unemployment rate, and average credit score were not significant on their own in third model, so we will see if they are jointly significant. The null hypothesis will be: $H_0 : \beta_2 = \beta_3 = \beta_5 = 0$, and the alternate hypothesis is the null hypothesis is not true. Utilizing the F-stat test, will be helpful in determining if these explanatory variables are significant together. The unrestrained model will be the Multiple Regression 2 (Model 3), and the restrained model will be the one that excludes the three individually insignificant explanatory variables, the average local tax rate, unemployment rate, and average credit score by state. The result from running the test was that $F_{3,44} = 1.27$, which was not jointly significant according to the F-distribution table with a 5% critical value, which leads us to fail to reject the null hypothesis.

Different Functional Form

After viewing the statistical properties of the state sales tax rate in the simple regression model, the results pointed to no statistical significance. This result was lower than initially expected because according to past research findings, there usually seems to be a more statistically significant value with taxes and GDP. Therefore, it was best to alter the functional form dealing with the state sales tax rate in order to extrapolate a more significant statistical level, in order to find a stronger relationship between the real GDP per capita by state, and the state sales tax rate. One of the most commonly used manipulated functional form deals with squaring the explanatory variable in order to find a relationship that was previously expected, but in a different form, such as a quadratic or cubic function. The new simple regression form, where squaredsstr represents the state sales tax rate squared as shown:

$$\textit{Real GDP Per Capita} = \beta_0 + \beta_1 \text{squaredsstr} + \text{u}$$

This model still contains a negative beta-one coefficient, which means for a single unit increase in the sales tax rate, which will be squared, the Real GDP per Capita decreases by -$99,4620.20, holding everything else constant. The beta-one changed from -88449.67 to -994620.20, which means the real GDP per capita will be lower for the sales tax rate squared over the initial explanatory variable when the sales tax rate increases by a unit. The intercept changed from 53653.7 to 52112.37, which is relatively stable based on the little change that was observed. The intercept can be interpreted as if there was no state sales tax rate, the intercept would represent the Real GDP per capita for the state would be $52,112.37.

Once the regression was ran, the beta values did not change signs, and did not change drastically from the initial model. In addition, we look at the statistical properties of the simple regression with the null hypothesis and the alternative hypothesis being the same as before. Moreover, the t-statistic value changed from -1.40 to -1.15 for the first beta value. This means that the significance of the explanatory variable dropped from the original model. Additionally, the p-value changed from 0.17 to 0.25, which means the lowest possible significance level at which the null hypothesis is still rejected increased. The p-value increasing means that the significance of the variable dropped because a lower p-value, and a higher t-value translates to a better statistical significance result. Lastly, the R-squared value dropped from the initial model, with a value of 0.0392 to 0.0270 for the different functional form model, therefore the goodness-of-fit decreased with the new functional form model. After utilizing a different functional form for the simple regression, the functional form was extended to the other regression models to see if there is an impact for the multiple regressions that were run previously.

For the first multiple regression model (Model 2), which included the state sales tax and the average local tax rate, the model was changed to make the state sales tax rate squared, just as in the case of the simple regression model. The model is depicted below:

$$\textit{Real GDP Per Capita} = \beta_0 + \beta_1 \text{ squaredsstr} + \beta_2 \text{ avglocaltr} + \text{u}$$

The same different functional form was applied to the second multiple regression model (Model 3), where the state sales tax rate was replaced with the state sales tax rate squared. The model is depicted below:

$$\textit{Real GDP Per Capita} = \beta_0 + \beta_1 \text{ squaredsstr} + \beta_2 \text{ avglocaltr} + \beta_3\text{unemployr} + \beta_4\text{fortune500} + \beta_5\text{avgcs} + \text{u}$$

The values of each of the beta coefficients for all of the varying models are consolidated within the table, utilizing the real GDP per capita per state as the dependent variable, and the standard errors within parenthesis:

Title: Estimation Results for the (State Sales Tax Rate)^2

Explanatory Variables (standard errors)	**Model (1)**	**Model (2)**	**Model (3)**
(State Sales Tax)^2	-994620.2 (861796.3)	-1134956 (890959.9)	-2134361** (834441.5)
Average Local Sales Tax		-58981.15 (86835.2)	-72345.5 (90735.34)
Unemployment Rate			-37212.08 (128963.3)
Number of Fortune 500 Companies			334.29*** (89.95)
Average Credit Score			106.72 (83.9)
Intercept	52112.37*** (2860.02)	53348.15*** (3403.33)	-17682.26 (58662.2)
Number of Observations	50	50	50
R-squared	0.03	0.04	0.29

*significant at 10%; **significant at 5%; ***significant at 1%

The statistical inference is consolidated into multiple tables (the null and alternative hypothesis being the same as before) by differing model specifications, where the explained variable is real GDP per capita for each state for every table below:

Title: Statistical Inference for Model 1

Independent Variables	**t**	**P > |t|**	**95% Conf. Interval**	**Hypothesis Resultant**
squaredsstr	-1.15	0.254	[-2727378, 738137.3]	Fail to Reject Null
_cons	18.22	0.000	[46361.92, 57862.82]	

Title: Statistical Inference for Model 2

Independent Variables	**t**	**P > |t|**	**95% Conf. Interval**	**Hypothesis Resultant**
squaredsstr	-1.27	0.21	[-2927336,657423.9]	Fail to Reject Null
avglocaltr	-0.68	0.50	[-233671,115708.7]	Fail to Reject Null
_cons	15.68	0.00	[46501.53,60194.76]	

Title: Statistical Inference for Model 3

Independent Variables	**t**	**P > |t|**	**95% Conf. Interval**	**Hypothesis Resultant**
squaredsstr	-2.56	0.01	[-3816067,-452654.6]	Reject Null; Accept Alternative
avglocaltr	-0.80	0.43	[-255210.6,110519.6]	Fail to Reject Null
unemployr	-0.29	0.77	[-297120.6,222696.5]	Fail to Reject Null
fortune500	3.72	0.00	[153.01,515.58]	Reject Null; Accept Alternative
avgcs	1.27	0.21	[-62.38,275.81]	Fail to Reject Null
_cons	-0.30	0.77	[-135908.1,100543.6]	

Second Different Functional Form

Another functional form that could provide a different perspective to the research would be altering the form of the dependent variable rather than the explanatory variable that was done previously. Instead of looking at a level-level model, it would be interesting and enriching to look at a model that considers the logarithm of the dependent variable (log-level model), which would be the Real GDP per capita for each state. The log-level model would keep the explanatory variables the same, but change the dependent variable to a logarithmic function (below is the illustration of the log-level model in a simple regression). In the subsequent models, the log of the real GDP per capita by state are written as *lrealgdppc*.

$$lrealgdppc = \beta_0 + \beta_1 \text{statestr} + \text{u}$$

The other two models are as follows:

Model 2:

$$lrealgdppc = \beta_0 + \beta_1 \text{ statestr} + \beta_2 \text{ avglocaltr} + \text{u}$$

Model 3:

$$lrealgdppc = \beta_0 + \beta_1 \text{ statestr} + \beta_2 \text{ avglocaltr} + \beta_3 \text{unemployr} + \beta_4 \text{fortune500} + \beta_5 \text{avgcs} + \text{u}$$

Each of these models will be interpreted as the Real GDP per Capita will increase or decrease by a certain percentage based on the coefficient of a specified explanatory variable, holding everything else constant.

The table below provides the corresponding coefficient to each of the three models, as well as the standard errors of the variables in parentheses.

Table: Estimation Results for Second Different Functional Form

Dependent Variable: ln(Real GDP Per Capita)			
Independent Variables (standard error)	**Model (1)**	**Model (2)**	**Model (3)**
State Sales Tax	-1.78 (1.29)	-1.83 (1.31)	-3.2** (1.21)
Average Local Sales Tax		-0.83 (1.72)	-0.72 (1.80)
Unemployment Rate			-1.74 (2.61)
Number of Fortune 500 Companies			0.01*** (0.00)
Average Credit Score			0.00 (0.00)
Intercept	10.88*** (0.07)	10.89*** (0.08)	9.53*** (1.19)
Number of observations	50	50	50
R-squared	0.04	0.04	0.30

*significant at 10%; **significant at 5%; ***significant at 1%

Along with comparing the statistical significance of each of these variables in the level-level model, it is also important to look at the statistical inferences that come along with the change in the functional form. Below are the three different models, along with the statistical inferences included, where the dependent variable is the log of the Real GDP per Capita, and the null and alternative hypothesis being the same as before:

Title: Model 1 Statistical Inference

Independent Variables	**t**	**P > |t|**	**95% Conf. Interval**	**Hypothesis Resultant**
statestr	-1.38	0.17	[-4.38,0.81]	Fail to Reject Null
_cons	154.19	0.00	[10.74,11.02]	

For the simple regression model, the hypothesis resultant stayed the same compared to the original simple regression model that was run.

Title: Model 2 Statistical Inference

Independent Variables	t	P > |t|	95% Conf. Interval	Hypothesis Resultant
statestr	-1.40	0.17	[-4.46,0.79]	Fail to Reject Null
avglocaltr	-0.48	0.63	[-4.29,2.64]	Fail to Reject Null
_cons	141.72	0.00	[10.74,11.05]	

In the second model, the hypothesis resultant stayed the same compared to the original multiple regression that was ran.

Title: Model 3 Statistical Inference

Independent Variable	t	P > |t|	95% Conf. Interval	Hypothesis Resultant
statestr	-2.66	0.01	[-5.63, -0.77]	Reject Null; Accept Alternative
avglocaltr	-0.40	0.69	[-4.35,2.90]	Fail to Reject Null
unemployr	-0.67	0.51	[-7.01,3.53]	Fail to Reject Null
fortune500	3.79	0.00	[0.00, 0.01]	Reject Null; Accept Alternative
avgcs	1.25	0.22	[-0.001, 0.01]	Fail to Reject Null
_cons	8.03	0.00	[7.14, 11.92]	

The last multiple regression model that was ran, had comparable results to the original model, and the hypothesis resultants stayed the same for the explanatory variables.

VI. Conclusion

Prior to exploring the effects of the state sales tax rate on the real GDP per capita by state, it was expected that increases in the state sales tax rates would lead to decreases in the real GDP per capita, because while taxes serve as revenue for the government, the negative effect they have on consumption would have a greater effect on real GDP per capita, due to previous research conducted on the effects of taxes on the economy. Moreover, the goal of this investigation was to provide insight and empirical support based on our hypothesis that there would be a certain relationship between the state sales tax rate and the real GDP per capita by state. Additionally, there were added explanatory variables to enrich the model, and to see other factors that could possibly impact the dependent variable under inspection, in order to avoid omitted variable bias, and create a regression that could explain a good percentage of what was occuring with the dependent variable. In the simple regression model, the state sales tax rate was not statistically significant, which meant that we would fail to reject the null hypothesis, which states that there does not exist a significant relationship between the state sales tax rate and the real GDP per capita. Furthermore, with an increase in the explanatory variables that included the average local tax rate, the statistical significance did not allow us to reject the null hypothesis once again. This significance level was not enough to warrant a rejection of the null hypothesis, but this led to further investigation into other explanatory variables. With our final regression model, we included five explanatory variables that could possibly impact the real GDP per Capita, which were investigated based on prior research that was conducted. After running the final regression with the third model, the state sales tax rate became statistically significant at the 5% level, as well as the the number of Fortune 500 companies by state being significant at the 1% level. With these significance levels, it was possible to reject the null and accept the alternative for these two variables, most importantly the state sales tax rate. In conjunction with the statistical significance of the explanatory variables, the R-squared value increased dramatically from the first simple regression to the last multiple regression. The simple regression model only gave a R-squared value of 0.04, but with the last multiple regression that number had increased to 0.29. Additionally, other functional forms were explored in order to find a stronger linkage between the state sales tax rate and the the real GDP per capita, which not only changed the independent variables, but also the dependent variable. The results were similar to the initial regression models, and no new extrapolations or trends could be made with the two additional functional forms to the three regression models.

Based off of the results that were attained, it would be concluded that there exists a negative beta coefficient for the state sales tax rate for all three regression models, with the statistical significance increasing from additional explanatory variables. Furthermore, the increase in one unit of the state sales tax rate led to a negative overall impact on the real GDP per capita, which is in line with other research that was conducted pertaining to taxes and GDP, such as Gale and Samwick (2017). Given these results, our hypothesis does indicate that there exists a negative relationship between the Real GDP per Capita and the state sales tax rate, which is in line with previous papers written about taxes and GDP. Lastly, based on the last multiple regression model, the state sales tax rate is statistically significant at the 5% level, which verifies the validity of our hypothesis.

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Appendix

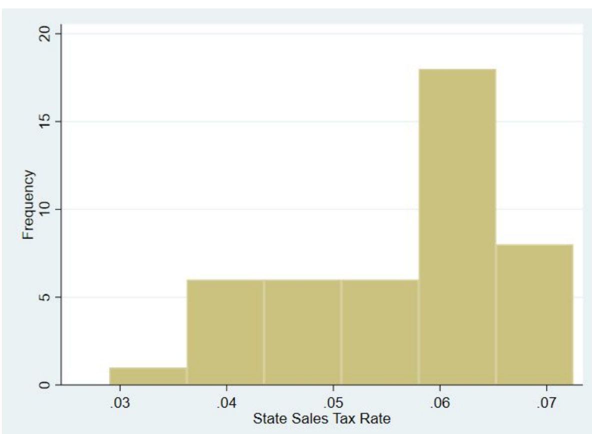
States included in the study (50):

Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming

States without a state sales tax (5):

Alaska, Delaware, Montana, New Hampshire, Oregon

Histogram: Frequency distribution of occurrence of state sales tax rates in 2017



STATA Output - Simple Regression Model

```
. regress realgdppc statestr

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(1, 48)        =      1.96
       Model |   150419412         1   150419412   Prob > F        =    0.1681
    Residual |  3.6857e+09        48  76785397.1   R-squared       =    0.0392
-------------+----------------------------------   Adj R-squared   =    0.0192
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    8762.7

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    statestr |  -88449.67   63195.13    -1.40   0.168      -215512    38612.65
       _cons |    53653.7   3453.578    15.54   0.000     46709.81    60597.58
------------------------------------------------------------------------------
```

STATA Output - Simple Regression Model (excluding Alaska, Delaware, Montana, New Hampshire, Oregon)

```
. regress realgdppc statestr

      Source |       SS           df       MS      Number of obs   =        45
-------------+----------------------------------   F(1, 43)        =      0.18
       Model |  13606271.8         1  13606271.8   Prob > F        =    0.6747
    Residual |  3.2766e+09        43  76199863.5   R-squared       =    0.0041
-------------+----------------------------------   Adj R-squared   =   -0.0190
       Total |  3.2902e+09        44  74777281.9   Root MSE        =    8729.3

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    statestr |  -53401.07   126373.9    -0.42   0.675    -308258.4    201456.2
       _cons |   51601.65    7279.84     7.09   0.000     36920.46    66282.85
------------------------------------------------------------------------------
```

STATA Output - Multiple Regression Model 1

```
. regress realgdppc statestr avglocaltr

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(2, 47)        =      1.09
       Model |   170498500         2  85249250.2   Prob > F        =    0.3436
    Residual |  3.6656e+09        47  77991914.3   R-squared       =    0.0444
-------------+----------------------------------   Adj R-squared   =    0.0038
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    8831.3

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    statestr |  -91007.63   63888.89    -1.42   0.161    -219535.5    37520.25
  avglocaltr |  -42814.31   84380.43    -0.51   0.614    -212565.8    126937.2
       _cons |   54376.99   3761.201    14.46   0.000     46810.43    61943.55
------------------------------------------------------------------------------
```

STATA Output - Multiple Regression Model 2 / Unrestrained Model

```
. regress realgdppc statestr avglocaltr unemployr fortune500 avgcs

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(5, 44)        =      3.64
       Model |  1.1215e+09         5   224299811   Prob > F        =    0.0077
    Residual |  2.7146e+09        44  61695895.8   R-squared       =    0.2924
-------------+----------------------------------   Adj R-squared   =    0.2119
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    7854.7

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    statestr |  -156966.2   59295.16    -2.65   0.011    -276467.8   -37464.66
  avglocaltr |  -39663.96   88393.52    -0.45   0.656    -217809.4    138481.5
   unemployr |  -66610.56     128542    -0.52   0.607    -325669.9    192448.8
  fortune500 |   332.1544   89.08315     3.73   0.001     152.6191    511.6897
       avgcs |   102.0816   83.39007     1.22   0.227    -65.98002    270.1433
       _cons |   -12208.9   58356.72    -0.21   0.835    -129819.1    105401.3
------------------------------------------------------------------------------
```

STATA Output - Restrained Model

```
. regress realgdppc statestr fortune500

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(2, 47)        =      7.02
       Model |   882210479         2   441105240   Prob > F        =    0.0022
    Residual |  2.9539e+09        47  62849106.2   R-squared       =    0.2300
-------------+----------------------------------   Adj R-squared   =    0.1972
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    7927.7

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    statestr |  -139355.1   59087.66    -2.36   0.023    -258224.2   -20486.07
  fortune500 |   294.2732   86.23961     3.41   0.001     120.7815    467.7649
       _cons |   53319.42   3126.028    17.06   0.000     47030.67    59608.18
------------------------------------------------------------------------------
```

STATA Output - Different Functional Form (1) Simple Regression (explanatory variables is the state sales tax rate squared)

```
. regress realgdppc squaredsstr

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(1, 48)        =      1.33
       Model |   103578254         1   103578254   Prob > F        =    0.2542
    Residual |  3.7325e+09        48  77761254.5   R-squared       =    0.0270
-------------+----------------------------------   Adj R-squared   =    0.0067
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    8818.2

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 squaredsstr |  -994620.2   861796.3    -1.15   0.254     -2727378    738137.3
       _cons |   52112.37   2860.018    18.22   0.000     46361.92    57862.82
------------------------------------------------------------------------------
```

STATA Output - Different Function Form (1) Multiple Regression 1

```
. regress realgdppc avglocaltr squaredsstr

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(2, 47)        =      0.89
       Model |   139860922         2  69930460.8   Prob > F        =    0.4178
    Residual |  3.6963e+09        47  78643777.7   R-squared       =    0.0365
-------------+----------------------------------   Adj R-squared   =   -0.0045
       Total |  3.8361e+09        49  78288132.1   Root MSE        =    8868.1

------------------------------------------------------------------------------
   realgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  avglocaltr |  -58981.15    86835.2    -0.68   0.500      -233671    115708.7
 squaredsstr |   -1134956   890959.9    -1.27   0.209     -2927336    657423.9
       _cons |   53348.15    3403.33    15.68   0.000     46501.53    60194.76
------------------------------------------------------------------------------
```

STATA Output - Different Functional Form (1) Multiple Regression 2

```
. regress realgdppc unemployr fortune500 avgcs avglocaltr squaredsstr
```

Source	SS	df	MS			
				Number of obs	=	50
				F(5, 44)	=	3.52
Model	1.0965e+09	5	219302988	Prob > F	=	0.0092
Residual	2.7396e+09	44	62263716.6	R-squared	=	0.2858
				Adj R-squared	=	0.2047
Total	3.8361e+09	49	78288132.1	Root MSE	=	7890.7

realgdppc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
unemployr	-37212.08	128963.3	-0.29	0.774	-297120.6	222696.5
fortune500	334.2937	89.95056	3.72	0.001	153.0103	515.5771
avgcs	106.7156	83.9034	1.27	0.210	-62.38061	275.8118
avglocaltr	-72345.5	90735.34	-0.80	0.430	-255210.6	110519.6
squaredsstr	-2134361	834441.5	-2.56	0.014	-3816067	-452654.6
_cons	-17682.26	58662.2	-0.30	0.765	-135908.1	100543.6

STATA Output - Different Functional Form (2) Simple Regression (explained variable is measured as the natural log of real GDP per capita)

```
. regress lrealgdppc statestr
```

Source	SS	df	MS			
				Number of obs	=	50
				F(1, 48)	=	1.91
Model	.061220324	1	.061220324	Prob > F	=	0.1733
Residual	1.53793775	48	.03204037	R-squared	=	0.0383
				Adj R-squared	=	0.0182
Total	1.59915808	49	.032635879	Root MSE	=	.179

lrealgdppc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
statestr	-1.7844	1.290901	-1.38	0.173	-4.379931	.8111316
_cons	10.87757	.070547	154.19	0.000	10.73572	11.01941

STATA Output - Different Functional Form (2) Multiple Regression 1

```
. regress lrealgdppc avglocaltr statestr
```

Source	SS	df	MS			
				Number of obs	=	50
				F(2, 47)	=	1.05
Model	.068693097	2	.034346549	Prob > F	=	0.3564
Residual	1.53046498	47	.032563085	R-squared	=	0.0430
				Adj R-squared	=	0.0022
Total	1.59915808	49	.032635879	Root MSE	=	.18045

lrealgdppc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
avglocaltr	-.8259577	1.724168	-0.48	0.634	-4.294537	2.642622
statestr	-1.833747	1.305459	-1.40	0.167	-4.459992	.7924988
_cons	10.89152	.0768536	141.72	0.000	10.73691	11.04613

STATA Output - Different Functional Form (2) Multiple Regression 2

```
. regress lrealgdppc unemployr fortune500 avgcs avglocaltr statestr

      Source |       SS           df       MS      Number of obs   =        50
-------------+----------------------------------   F(5, 44)        =      3.74
       Model |  .476921903         5  .095384381   Prob > F        =    0.0066
    Residual |  1.12223618        44  .025505368   R-squared       =    0.2982
-------------+----------------------------------   Adj R-squared   =    0.2185
       Total |  1.59915808        49  .032635879   Root MSE        =     .1597

------------------------------------------------------------------------------
  lrealgdppc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   unemployr |  -1.741658   2.613561    -0.67   0.509    -7.008944    3.525629
  fortune500 |   .0068719   .0018113     3.79   0.000     .0032215    .0105222
       avgcs |   .0021122   .0016955     1.25   0.219    -.0013049    .0055293
  avglocaltr |  -.7235248   1.797248    -0.40   0.689    -4.345641    2.898591
    statestr |   -3.20153    1.20561    -2.66   0.011    -5.631278   -.7717825
       _cons |   9.527437   1.186529     8.03   0.000     7.136144    11.91873
------------------------------------------------------------------------------
```