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Abstract
This paper seeks to understand the impact that state tax code structuring has on a state's ability to fund K-12 education using a multiple regression model to evaluate the regressivity of a state's tax code on it's per student funding for K-12 education. Using empirical data collected and analyzed by the Institute on Taxation and Economic Policy (ITEP), this paper first utilizes a bivariate correlation matrix and then an ordinary least squares regression model to explain if tax code regressivity, or any other controlled variables, have any impact over spending per student in K-12 education by the state. The findings do not support the hypothesis that regressive state tax codes lead to less spending per student on K-12 education.

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Introduction

Over the last several decades, a number of factors have been studied and written about addressing the quality of education and the number of tax dollars that go to fund that education. The desire for more modernized schools, a necessity to become more competitive on a global scale, and high-profile disagreements on how public schools should be funded have all led to vigorous debates on how the state should finance and provide an education to America's youth. Although some may look to the federal government in terms of K-12 education funding, the Constitution allots the responsibility of education to the states.

At the state level, one of the largest debates occurring is whether states should be spending more or less on K-12 education. Questions remain as to whether more money per student leads to better quality education and higher levels of achievement. State legislatures across the country need to decide annually what level they want invest tax-money into their public-school system. Other explanatory factors on state spending per student exist as well, such as a state's "cultural value" they place on education, political pressure from voters, and the education level of a the state's electorate. While this paper will review previous research into the impact of increased funding on achievement, and several other factors listed above, the goal of

this research is to examine the ability of a state to finance greater levels of spending on education.

This paper attempts to address how the structure of a state's tax code impacts the state's ability to fund K-12 education. This research will not attempt to answer the question as to whether more money spent by the state has positive, negative, or neutral implications on academic achievement, rather I will assume that spending more money per student will likely not have a negative impact on academic achievement. This paper will look to advise state legislators on which tax code structures best enable them to further fund education spending per student. I will be using the Institute on Taxation and Economic Policy's (ITEP) tax inequality index against the National Education Association's (NEA) spending per student data table to examine if a relationship exists between tax code regressivity and K-12 spending per student across all 50 states and the District of Columbia (D.C.).

The hypothesis is that as a state's tax code becomes more regressive, K-12 education spending per student will decline. The theory behind this hypothesis is based on the idea that more regressive tax structures will inadequately equip states with the ability to fund education per student at sufficient levels.

Literature Review

Although this research will avoid the question of money's impact on academic achievement, it is important to recognize the ongoing debate as to whether increased funding per student leads to better results in the classroom. The results have been mixed regarding this question.

Several studies have both supported and cast doubt on the impact of money on achievement. Picus and Robillard (2000) concluded that there is no link between school spending

and academic achievement. They helped confirm a 1996 study by authors Murnane and Levy who also found that increased funding or resources did not lead to greater academic success.

However, there have been studies conducted which have concluded that increased funding can lead to better academic results. Verstegen and King (1998), Sebold (1981) and Card and Payne (2002) found modest, but statistically significant, connections between increased funding for K-12 education and academic achievement of students. Figlio (1997) took a different approach and studied 49 states and how property tax limitations on school services impacted academic achievement. Figlio found that when states limited how much property tax could be spent on school services, academic achievement declined as school district funding was restricted. In addition to Figlio's research, Wenglinsky (1997) found an indirect relationship between a school district's economic resources to fund school services and academic achievement. Wenglinsky stated:

> "The study tested the notion that through a certain 'path,' certain economic resources are associated with academic achievement. The path begins with the hypothesis that per-pupil expenditures on instruction and the administration of school districts' central offices are positively related to class size, with more spending leading to smaller classes. Class size is, in turn, positively related to school social environment, with schools having more cohesive social environments when they have smaller classes. Finally, cohesive school environments are positively related to students' achievement above and beyond students' social backgrounds."

While this debate has yet to be-settled, this supports the assumption that increased spending may not actually increase student academic performance, it does no harm. As research into this issue

continues, this paper will look to better inform legislators of tax code implications on their state's education spending and educational outcomes.

Research Design and Methodology

To research the effect of tax code regressivity on K-12 education spending per student across the 50 states, I used the ITEP's tax inequality index as a baseline to measure tax regressivity. The ITEP's tax inequality index factors in a variety taxes across each state such as state income tax, property tax, sales and excise taxes, and estate tax. The index then calculates a state tax system's effect on income inequality between the bottom 20% of earners, the middle 60% of earners, and the top 1% from pre-tax income to post-tax income (*Who Pays*, 2015). Negative values indicate that income inequality grows under the state's tax system while positive values indicate that income inequality shrinks under the state's tax system. Thus, if inequality rises, the regressivity of a state's tax system rises. This study use ITEP's inequality index as a measure because it is the only index that has created one uniform standard across each state that takes into consideration all taxes of the state, excluding federal taxes.

This index was ideal for several reasons. First, while there is a misconception that income taxes drive inequality, the most regressive states see their regressivity come mostly from sales and excise taxes, and property taxes. Therefore, it was imperative that any measure of regressivity include the impact of taxes beyond income tax. Secondly, each state draws from different tax revenue sources to fund its K-12 education; often income taxes don't go towards education spending. Therefore, using only income taxes as a measure of regressivity wouldn't have been as accurate a measure as including multiple prominent tax sources across each state. Finally, the ITEP was able distinguish between state and local taxes and factor them together into one index. Local taxes have an almost equal part to state taxes in paying for K-12 education

spending and have an important role in either increasing or decreasing a state's overall tax inequality

Next it was determined to how to best measure K-12 education spending by the state. It became clear that measuring the amount of money spent per student would an accurate measure that could be easily understood. A variable often used to judge a school's quality is the amount of funding it receives per student currently enrolled and this measure controls for variance in the population. This data was collected from the NEA for funding per student for enrollments in the Fall 2016 (*Rankings and Estimates*).

Lastly, 15 additional control variables were introduced to the bivariate correlation matrix in addition to the least squares regression model. Those variables were: K-12 education spending per capita (*Rankings and Estimates*), percentage of adult population with a high school diploma, percentage of adult population with a bachelor's degree, percentage African American population, percentage Hispanic population (*Population Distribution by Race/Ethnicity*, 2017), median household income, poverty rate (Poverty USA), number of operating school districts (*Rankings and Estimates*), percentage of K-12 education funding provided by the federal government, state government and local governments (*Grant Distribution Formulas*), percentage of Republicans in the state legislature, party of the governor, (*2017 State & Legislative Partisan Composition*), urbanization, cost of living index, and state political culture.

Two separate tests were conducted, each with two sub-tests to evaluate the impact of each of these variables on K-12 education spending per student. The two initial tests varied between including or excluding D.C. from the data. Each of these tests consisted of first producing a bivariate correlation matrix between all variables. This matrix was used to begin addressing any multicollinearity issues. Any correlation of .7 or above was noted, and a

correlation threshold of .84 was established to remove a variable. Variables were removed based on theoretical relevance to the hypothesis.

The remaining variables will then be put through several rounds of ordinary least squares regressions, removing variables each round until all multicollinearity issues were removed. The sub-tests involved two different treatments for these missing values. Sub-test "A" for each test would exclude the missing cases listwise while sub-test "B" would replace the missing values with the mean of that variable's dataset. For each test and its sub-tests, multicollinearity was measured by both the variable's tolerance and variance inflation factor (VIF) measures. A threshold of less than 2.0 for tolerance, and greater than 5.0 for VIF was set to remove a variable. One variable would be removed each time a regression was run until no variables remaining met the established threshold. Variables were removed first based on tolerance, and VIF measures with the variable with the lowest tolerance and highest VIF score being removed. If two variables were within .01 of each for either score, the one with less theoretical importance was removed. The final regression model would be the one where no variables met the established multicollinearity threshold and results would be extrapolated from that model.

Test 1, which included D.C., had seven bivariate correlations that exceeded .7, and two that exceed the .84 threshold (Table 1). K-12 spending per capita and percentage of school funding from local governments were removed from further testing. Spending per capita was removed because it was too closely correlated with spending per student, the primary dependent variable of this research. Local government spending was removed because it was almost identically correlated with funding from state governments. Given that this research is focused primarily at the state level, local government funding was removed. Test 1 was then split in to Test 1A and Test 1B.

Test 1A went through four rounds of ordinary least squares regression modeling before multicollinearity was lowered to a satisfactory level within the established threshold. Poverty rate, median household income, and percentage of adults with high school diplomas were removed in that order during the first three rounds (Table 2). Round four saw no multicollinearity issues and results collected (Table 7).

Test 1B underwent three rounds of ordinary least squares regression modeling before multicollinearity was lowered to a satisfactory level within the established threshold. Median household income and percentage of adults with high school diplomas were removed in that order during the first two rounds (Table 3). Round three saw no multicollinearity issues and results were drawn from there (Table 8).

Test 2, which excluded D.C., had eight bivariate correlations that exceeded .7 and three that exceed the .84 threshold (Table 4). K-12 spending per capita, percentage of school funding from local governments and poverty rate were removed from further testing. As noted for Test 1, spending per capita was removed because it correlated too closely with spending per student. Also, as specified earlier for Test 1, local government spending was removed because it was almost identically correlated with funding from state governments. Poverty rate was removed because it was too closely related to median household income, median income was theorized to play a more direct role in funding education so it was kept. Test 2 was then split in to Test 2A and Test 2B.

Tests 2A and 2B underwent three rounds of ordinary least squares regression modeling before multicollinearity was lowered to a satisfactory level within the established threshold. Median household income and percentage of adults with high school diplomas were removed in

that order during the first two rounds for both sub-tests (Tables 5 & 6). Round three saw no multicollinearity issues for either sub-test and results collected (Tables 9 & 10).

Results and Analysis

In order to evaluate the hypothesis, the final round of regression from each subtest was used to account for the significance between my variables and the strength of any relationships. The established significance level threshold was .05 for all testing.

Table 7 shows the final regression model results for Test 1A. The final model had an R value of .754, an R-Squared of .569, an Adjusted R-Square of .425, and Significance of .001. After removing issues of multicollinearity, Test 1A found no significant relationships at the .05 level.

Table 8 shows the final regression model results for Test 1B. After removing issues of multicollinearity, Test 1B found no significant relationships at the .05 level. The model had an R value of .778, an R-Squared of .605, an Adjusted R-Square of .466 (.480 if poverty rate is removed), and Significance of .000. However, an additional variable, poverty rate, was removed to replicate the variables removed in Test 1A. Upon removing poverty rate, the cost of living index and percentage of adults with bachelor's degrees became significant at the .05 level, with beta weights of .348 and .381 respectively.

Table 9 shows the final regression model results for Test 2A. The model has a R value of .754, an R-Squared of .569, an Adjusted R-Square of .425, and Significance of .001. After removing issues of multicollinearity, there were no significant relationships at the .05 level.

Table 10 shows the final regression model results for Test 2B. The model has an R value of .752, an R-Squared of .566, an Adjusted R-Square of .425, and Significance of .001. After

removing issues of multicollinearity, there was one significant relationships at the .05 level. The Cost of living index was significant at the .05 level, with a beta weight of .405.

Across all testing conducted, I am unable to reject my null hypothesis. I am unable to draw any assumptions that a state's tax system has any impact on how much that state funds K-12 education spending per student. While the cost of living index was significant in Tests 1B and 2B and percentage of adults with bachelor's degrees was significant in Test 1B, a degree of skepticism should be maintained about their true impact on education spending as well.

In Test 1B, after all multicollinearity measures fell outside the established threshold for variable removal, there were no significant variables. Only after I removed an additional variable, poverty rate, out of intellectual curiosity and to mirror Test 1A's removals, did cost of living and adult college education become significant. Only in Test 2B was cost of living index significant after following my research design as established. In Test 2B, the data excluded D.C. from being considered and replaced missing values for variables with the mean of that variable rather than excluding those cases. I raise this observation because the few values that were missing from the dataset were for percentage of Republicans in the state legislature, and the party of the governor. When analyzing tax codes, cross-sectional variables of the party makeup of a state legislator and governor's party were not best suited for this study, because tax codes are developed and changed infrequently over-time. To put the entire current tax system of a state on one year's state legislature and governor is not as accurate as looking at party control of a state over time. Replacing the missing values of those variables with the mean may have had a disproportionate impact on the significance of the other variables.

However, if my previous comments are disregarded for a moment, there could be theoretical reasons why cost of living index was able to become significant in its own right.

Given that education quality was ignored in this study, my regression models would have held quality constant across the 50 states and D.C. It makes sense that as the cost of living in a state increases, the costs associated with operating a school will as well. Needing to pay higher salaries to staff, increased supply costs, increased overhead would naturally require states to pay more money per student for the same quality education in a state with a higher cost of living than a state with a lower cost of living. Receiving the same educational experience in Alabama compared to in Massachusetts would theoretically cost more in the latter compared to the former due to their vast difference in cost of living. Future research will be needed to confirm if this theory holds any empirical reality.

Conclusion

Through this research, I was unable to reject my null hypothesis. However, there is room for improvement in this research that could yield more fruitful results. Future research should consider incorporating party control of each state over time. Looking at state party control over time may lend more insight to party influence over both the tax code and to K-12 education spending. In addition, factoring in party and ideology of the state's electorate could identify more clearly the role partisanship plays in both tax and education policy of the states. There may also be benefits to adding in quality of education as a variable to analyze how money impacts quality or vice versa.

Table 1: Bivariate Correlations >0.7 with D.C.

Correlated Variables	Pearson Correlation Values
Per Student Spending & Per Capita Spending	**.852****
High School Diploma & Poverty Rate	-.787**
High School Diploma & Political Culture	.707**
Bachelor's Degree & Median Household Income	.769**
Poverty Rate & Median Household Income	-.813**
State Government Funding & Local Government Funding	**-.974****
Cost of Living Index & Percent Republican in State Leg.	-.773**

**Correlation is significant at the .01 level (two-tail), see Appendix A for SPSS data table

Table 2: Test 1A Multicollinearity Regression Model Results

	Round 1		Round 2		Round 3		Final Round	
Variable	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**
Tax Inequality Index	.729	1.371	.731	1.369	.737	1.356	.747	1.339
High School Diploma	.104	9.588	.137	7.308	.144	6.953	-	-
Bachelor's Degree	.138	7.257	.139	7.194	.193	5.187	.311	3.216
African American Pop.	.283	3.539	.284	3.523	.285	3.515	.436	2.295
Hispanic Pop.	.212	4.718	.212	4.717	.213	4.704	.377	2.654
Median Household Income	.084	11.855	.126	7.964	-	-	-	-
Poverty Rate	.083	12.004	-	-	-	-	-	-
Operating School Districts	.716	1.398	.730	1.370	.730	1.369	.814	1.228
State Gov Funding	.734	1.363	.753	1.329	.758	1.318	.780	1.281
Federal Gov Funding	.371	2.695	.469	2.132	.469	2.130	.491	2.037
State Leg. Republican	.236	4.244	.236	4.238	.289	3.464	.314	3.182
Governor's Party	.660	1.514	.684	1.462	.693	1.443	.723	1.384
Urbanization	.245	4.078	.247	4.061	.297	3.364	.330	3.030
Cost of Living	.199	5.035	.200	5.012	.307	3.257	.308	3.245
Political Culture	.329	3.041	.329	3.041	.331	3.026	.398	2.511

See Appendix B for SPSS data table

Table 3: Test 1B Multicollinearity Regression Model Results

	Round 1		Round 2		Final Round	
Variable	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**
Tax Inequality Index	.717	1.395	.720	1.389	.721	1.387
High School Diploma	.113	8.811	.114	8.776	-	-
Bachelor's Degree	.107	9.311	.166	6.041	.242	4.129
African American Pop.	.218	4.593	.219	4.569	.308	3.246
Hispanic Pop.	.220	4.549	.221	4.532	.340	2.943
Median Household Income	.085	11.744	-	-	-	-
Poverty Rate	.106	9.427	.154	6.482	.202	4.940
Operating School Districts	.716	1.397	.720	1.390	.773	1.293
State Gov Funding	.613	1.633	.620	1.612	.629	1.589
Federal Gov Funding	.379	2.637	.401	2.491	.466	2.145
State Leg. Republican	.215	4.659	.243	4.115	.244	4.100
Governor's Party	.698	1.432	.699	1.431	.710	1.409
Urbanization	.234	4.272	.279	3.578	.292	3.421
Cost of Living	.208	4.808	.252	3.963	.286	3.499
Political Culture	.331	3.024	.331	3.023	.363	2.755

See Appendix C for SPSS data table

Table 4: Bivariate Correlations >0.7 without D.C.

Correlated Variables	Pearson Correlation Values
Per Student Spending & Per Capita Spending	**.846****
High School Diploma & Poverty Rate	-.803**
High School Diploma & Political Culture	.728**
Bachelor's Degree & Median Household Income	.832**
Poverty Rate & Median Household Income	**-.863****
State Government Funding & Local Government Funding	**-.968****
Cost of Living Index & Percent Republican in State Leg.	-.773**
Bachelor's Degree & Poverty Rate	-.726**

**Correlation is significant at the .01 level (two-tail), see Appendix D for SPSS data table

Table 5: Test 2A Multicollinearity Regression Model Results

	Round 1		Round 2		Final Round	
Variable	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**
Tax Inequality Index	.731	1.369	.737	1.356	.747	1.339
High School Diploma	.137	7.308	.144	6.953	-	-
Bachelor's Degree	.139	7.194	.193	5.187	.311	3.216
African American Pop.	.284	3.523	.285	3.515	.436	2.295
Hispanic Pop.	.212	4.717	.213	4.704	.377	2.654
Median Household Income	.126	7.964	-	-	-	-
Operating School Districts	.730	1.370	.730	1.369	.814	1.228
State Gov Funding	.753	1.329	.758	1.318	.780	1.281
Federal Gov Funding	.469	2.132	.469	2.130	.491	2.037
State Leg. Republican	.236	4.238	.289	3.464	.314	3.182
Governor's Party	.684	1.462	.693	1.443	.723	1.384
Urbanization	.247	4.041	.297	3.364	.330	3.030
Cost of Living	.200	5.012	.307	3.257	.308	3.245
Political Culture	.329	3.041	.331	3.026	.398	2.511

See Appendix E for SPSS data table

Table 6: Test 2B Multicollinearity Regression Model Results

	Round 1		Round 2		Final Round	
Variable	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**
Tax Inequality Index	.739	1.352	.745	1.342	.751	1.331
High School Diploma	.141	7.101	.149	6.692	-	-
Bachelor's Degree	.144	6.940	.199	5.021	.312	3.207
African American Pop.	.281	3.554	.282	3.547	.442	2.263
Hispanic Pop.	.216	4.620	.217	4.611	.377	2.654
Median Household Income	.126	7.927	-	-	-	-
Operating School Districts	.729	1.371	.730	1.371	.821	1.218
State Gov Funding	.769	1.300	.774	1.293	.787	1.271
Federal Gov Funding	.477	2.095	.478	2.091	.493	2.029
State Leg. Republican	.249	4.017	.303	3.295	.323	3.093
Governor's Party	.678	1.475	.687	1.456	.719	1.391
Urbanization	.250	4.001	.299	3.344	.330	3.030
Cost of Living	.203	4.916	.312	3.204	.315	3.170
Political Culture	.337	2.966	.338	2.954	.400	2.499

See Appendix F for SPSS data table

Table 7: Final Test 1A Regression Model Results

Variable	Significance	Beta Weight
Tax Inequality Index	.536	.079
Bachelor's Degree	.198	.258
African American Pop.	.861	-.029
Hispanic Pop.	.314	-.182
Operating School Districts	.278	.134
State Gov Funding	.713	.046
Federal Gov Funding	.074	-.287
State Leg. Republican	.372	-.176
Governor's Party	.473	.093
Urbanization	.318	-.193
Cost of Living	.061	.381
Political Culture	.182	-.236

See Appendix B for SPSS data table

Table 8: Final Test 1B Regression Model Results

Variable	Significance	Beta Weight
Tax Inequality Index	.504	.082
Bachelor's Degree	.080*	.378
African American Pop.	.959	-.010
Hispanic Pop.	.307	-.184
Poverty Rate	.973	-.008
Operating School Districts	.271	.131
State Gov Funding	.694	.052
Federal Gov Funding	.135	-.231
State Leg. Republican	.373	-.189
Governor's Party	.445	.095
Urbanization	.350	-.181
Cost of Living	.082*	.345
Political Culture	.177	-.236

*Significant at the .05 level if poverty rate is removed, See Appendix C for SPSS data table

Table 9: Final Test 2A Regression Model Results

Variable	Significance	Beta Weight
Tax Inequality Index	.536	.079
Bachelor's Degree	.198	.258
African American Pop.	.861	-.029
Hispanic Pop.	.314	-.182
Operating School Districts	.278	.134
State Gov Funding	.713	.046
Federal Gov Funding	.074	-.287
State Leg. Republican	.372	-.176
Governor's Party	.473	.093
Urbanization	.318	-.193
Cost of Living	.061	.381
Political Culture	.182	-.236

See Appendix E for SPSS data table

Table 10: Final Test 2B Regression Model Results

Variable	Significance	Beta Weight
Tax Inequality Index	.566	.072
Bachelor's Degree	.182	.264
African American Pop.	.934	-.014
Hispanic Pop.	.313	-.181
Operating School Districts	.246	.141
State Gov Funding	.634	.059
Federal Gov Funding	.084	-.274
State Leg. Republican	.419	-.156
Governor's Party	.492	.089
Urbanization	.316	-.192
Cost of Living	.043*	.405
Political Culture	.191	-.228

*Significant at the .05 level, see Appendix F for SPSS data table

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Illinois Wesleyan University

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Knowledge and Wisdom