THE EFFECT OF PROPERTY TAX RELIEF ON K-12 EDUCATION EXPENDITURES IN NORTH DAKOTA

A Thesis
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Sciences

By

Kole Allen Nichols

In Partial Fulfillment of the Requirements
for the Degree of
MASTER OF SCIENCE

Major Department:
Agribusiness and Applied Economics

September 2021

Fargo, North Dakota

North Dakota State University
Graduate School

Title

The Effect of Property Tax Relief on K-12 Education Expenditures in North Dakota

By

Kole Allen Nichols

The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

MASTER OF SCIENCE

SUPERVISORY COMMITTEE:

Dr. Jeremy Jackson
Chair

Dr. Ryan Yonk

Dr. Clay Routledge

Dr. Raymond March

Approved:

10/04/21 — Date

Dr. William Nganje — Department Chair

ABSTRACT

North Dakota implemented two pieces of legislation in 2009 and 2013 to reduce property tax burdens. These policies encouraged local school districts to lower their property-tax mill rates and provided intergovernmental grants to school districts to replace the missing revenue. In this study I examine the effect of this change in policy on total school district expenditures. I employ panel econometric methods to analyze the effect that these property tax relief interventions had on county education expenditures in North Dakota. Though there were mixed results for the effect of the 2009 legislation, this study finds that the property tax relief that occurred in 2013 led to increases in expenditures where a one-mill reduction in local school district mill levies increases per pupil education expenditures by $40 - $65. This validates my hypothesis that property tax relief led to the occurrence of fiscal illusion and subsequently increased expenditures on education.

ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Jeremy Jackson, for his guidance, support, patience, and for investing in me and my academic journey at NDSU. His efforts into investing in the student learning process have made it possible for me to accomplish and learn far more than I could ever had without him. I would also like to thank my committee members, Dr. Ray March, Dr. Ryan Yonk, and Dr. Clay Routledge, for the time they have invested in me and for the feedback they so graciously provided for this project.

I would like as well to thank my parents, grandparents, sister and other close family. They continually invested time and resources into my growth as a student and in all the activities and opportunities I have pursued. Without them, this would never be possible.

TABLE OF CONTENTS

ABSTRACT iii

ACKNOWLEDGEMENTS iv

LIST OF TABLES vii

LIST OF FIGURES viii

LIST OF APPENDIX TABLES ix

CHAPTER 1. INTRODUCTION 1

1.1. Overview 1

1.2. Procedures 3

1.3. Study Organization 3

CHAPTER 2. LITERATURE REVIEW 4

2.1. Fiscal Illusion: Theoretical Underpinnings 4

2.2. Fiscal Illusion: Empirical Papers 7

2.3. Public Education Finance Restructuring/Equalization Literature 10

2.4. Framework Papers 12

2.5. Replication Paper: Zhao and Jung (2008) 13

CHAPTER 3. PROPERTY TAX AND EDUCATIONAL FINANCE HISTORY AND BACKGROUND 17

3.1. Property Taxes 17

3.2. North Dakota Property Tax Background and Analysis 20

3.3. North Dakota Property Tax and Public Education Finance History, Pre-2009 24

3.4. Funding Structure Pre-2009 & 2013 Legislation 26

3.5. 2009 Property Tax Relief 26

3.6. 2013 Funding Formula Change & Second Round of Property Tax Relief: 27

3.7. School District Mill Levy Limitations and Background 29

3.8. Review and Summary of Major Policy Changes and Effects 31

CHAPTER 4. MODEL AND DATA 34

4.1. Empirical Model 34

4.2. Data 38

CHAPTER 5. EMPIRICAL RESULTS 45

5.1. Reduction in Average County Levies on Cost of Education 45

5.2. School District Total Levy Reductions on Cost of Education 49

CHAPTER 6. SUMMARY, DISCUSSION AND CONCLUSION 55

6.1. Summary 55

6.2. Implications 56

6.3. Extensions to Research 57

REFERENCES 58

APPENDIX A. SUMMARY OF MAJOR RELEVANT POLICY CHANGES 66

APPENDIX B. MODEL ITERATION RUN AT SCHOOL DISTRICT LEVEL 67

APPENDIX C. ROBUSTNESS CHECK USING PROPTAXRELIEF1MILLREDUCTION 69

APPENDIX D. ANALYSIS OF ELASTICITIES FROM PRIMARY MODEL 72

APPENDIX E. TESTING SUBCOMPONENT PER-PUPIL EXPENDITURES VARIABLES 76

LIST OF TABLES

Table Page

3.1. Mill Limits by Level of Government in North Dakota 21

3.2. Maximum General School District Mill Levy by Year 29

3.3. Max Mill Rate by Type of School District Levy 30

4.1. Variable Descriptions 42

4.2. Summary Statistics 44

5.1. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2Count on CostPPExp 46

5.2. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2County on CostPPAllEducExp 48

5.3. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2SchoolDist on CostPPExp 50

5.4. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2SchoolDist on CostPPAllEducExp 52

LIST OF FIGURES

Figure Page

3.1. Proportion of Education Funding by Source 18

3.2. Percent of Property Taxes by Taxing District........ 22

3.3. Total County Level and School District Tax Collections:........ 23

3.4. School District Property Taxes as Proportion of Total........ 23

3.5. Total and Per Capita Education Expenditures 24

3.6. Average of School District Mill Rates by Year........ 30

3.7. Total Expenditures and Enrollment, 2005-2018:........ 31

3.8. Annual Rate of Change, Total Education Expenditures and Enrollment, 2005-2018........ 32

3.9. Per Capita Expenditures, 2005-2018. 32

LIST OF APPENDIX TABLES

Table Page

A.1. Summary of Major Relevant Policy Changes 66

B.1. Model Iteration Run at School District Level 67

C.1. PropTaxRelief1MillReduction, PropTaxRelief2Dummy, & PropTaxRelief2SchoolDist on CostPPAllEducExp and CostPPExp 70

D.1. Elasticity Analysis: LPropTaxRelief1Allocation, LPropTaxRelief2SchoolDist on LCostPPAllEducExp 73

D.2. Elasticity Analysis: LPropTaxRelief1Allocation, LPropTaxRelief2SchoolDist on LCostPPExp 74

E.1. PropTaxRelief1Allocation, PropTaxRelief2Dummy, & PropTaxRelief2County on CAPEXPPP, ADMEXPPP, and STFALPP 77

E.2. PropTaxRelief1Allocation, PropTaxRelief2Dummy, & PropTaxRelief2SchoolDist on CAPEXPPP, ADMEXPPP, and STFALPP 78

CHAPTER 1. INTRODUCTION

1.1. Overview

In 2009, North Dakota implemented a major property tax change (termed by the state government and here on out throughout this paper as property tax relief package) designed to lessen the burden of local school district property taxes (North Dakota Legislative Council, 2009). This bipartisan bill, SB 2199, provided general property tax relief through local property tax mill levy relief grants. The implementation of this policy constituted the state government allocating funds in the form of intergovernmental grants to school districts to make up for missing local revenue (North Dakota Legislative Branch, 2009a). This bill cut property taxes for property owners in the state by $300 million over the 2009-2011 biennium or by nearly 1/5th of the total value in property taxes collected from the previous biennium, 2007-2009 (North Dakota Legislative Council, 2009). Revenue lost from the property tax relief replaced by oil tax revenue (Grand Forks Herald, 2009). This occurred at a time when oil and gas taxes, a large revenue source for the state government, had more than doubled from three years prior and was on an exponential upward trajectory (Office of the North Dakota Tax Commissioner, 2012). This policy was enacted in tandem with slight increases in allocations to school districts to improve equity for districts with smaller property tax bases (North Dakota Legislative Council, 2019).

A few years later, in 2013, another legislative package was passed on the final day of the 2013 biennial legislative session that increased the property tax relief and restructured the educational funding system in the state. This bill, HB 1013 extended the reductions from SB 2199 to encourage local school districts to lower their mill levies even further. In addition, this law increased per student funding allocation from the state and local governments to provide greater educational funding equity. Overall, this legislation resulted in a reduction in collected property taxes of over $600 million (Smith, 2013) and a dramatic expansion in education expenditures (North Dakota Legislative Council, 2019).

In both the 2009 and 2013 legislation the state government implemented mechanisms to transfer money to local school districts to make up for the missing revenue collected from the reduction in property tax mill levies. This resulted in the state government increasing its revenue burden and a subsequent reduction in local property tax funding. The legislation also created a more complex revenue and funding structure for public education in the state by implementing additional intergovernmental transfer programs and funding formulas. Consequently, the salience of the tax burden individuals incurred in their funding of public services including public education likely decreased, due to the increased complication in observing the revenue collections, and transfers that now constituted a much larger share of the funding of school districts.

These programs were not designed to reduce overall expenditures but substituted local property tax collections for money coming from the state government to fund education, increasing the complexity of the funding structure while reducing the salience of the collection of taxes and their subsequent expenditure. Studies of similar programs have attempted to identify the existence of the theory of fiscal illusion. Fiscal illusion "… refers to a systematic misperception of fiscal parameters [by taxpayers] […] [which] results in a public sector of excessive size," (Oates 1985, pg. 67). A review of the empirical literature has demonstrated that such fiscal illusion leads to increased public expenditures (Wagner 1976, Sjoquist 1982, Schneider 1986, Dollery & Worthington, 1996, Brien & Sjoquist 2014, Zhao & Jung 2008). These two policy interventions that occurred in North Dakota fit the parameters of a possible occurrence of fiscal illusion.

1.2. Procedures

This paper is an analysis of the effects of North Dakota SB 2199 and HB 1013 (referred to the 2009 and 2013 legislation throughout the rest of the document, respectively) on state education expenditures. I attempt to identify if either of these policies resulted in fiscal illusion of public expenditures, using the degree of property tax relief that was implemented as the instrument to determine if fiscal illusion occurred. To conduct this study, I collected data at the school district and county level in North Dakota, depending on source and granularity. The school district data is aggregated to the county level. I used different iterations of panel-fixed effects regression models using data from all counties in the state from 2005-2018 test the effect implementation of the two distinct policies on per-student education expenditures. Controls are included to account for other factors of variation that may affect property tax collections and education expenditures in the county and two-way fixed effects are also employed to control for unobserved exogenous time-related factors, such as other policy changes, that may influence increases in per-pupil education expenditures.

1.3. Study Organization

This paper is organized as follows: Chapter 2 is a review of the relevant literature pertaining to fiscal illusion and state educational finance. Chapter 3 provides a brief history and background of property taxes and how they are structured in North Dakota. It also reviews the educational funding structures in the state and the changes that occurred prior to, during, and after the implementation of the two property tax relief packages. Chapter 4 presents the empirical model to be used in the analysis. Chapter 5 presents the results from this empirical model. Chapter 6 concludes and provides further discussion and implications for my findings.

CHAPTER 2. LITERATURE REVIEW

This chapter reviews the relevant literature. There are five subsections of this chapter. The first lays out the theoretical underpinnings of the concept of fiscal illusion, the theory framing my analysis. The second section reviews studies that empirically test public finance data to identify instances of fiscal illusion, and the third section presents papers relating to the impact of state education funding restructuring, two areas of the literature pertinent to the framing of this study. The final two sections review papers relevant to the approach taken in this study, with the paper reviewed in the final section being used to provide a general groundwork for the approach and empirical methodology I use in my analysis.

2.1. Fiscal Illusion: Theoretical Underpinnings

Fiscal illusion is the notion that decreasing the observability of public revenue collection and expenditure through various means leads to a government of a larger size (Oates, 1985). Throughout the literature, there are a multitude of methods and approaches to analyzing the effects of different taxation, revenue and expenditure structures on performance and public perception of the tax burden.

The seminal paper on fiscal illusion is Puviani (1903). In this piece, the author provides the assumption that the state acts as a monopoly, where the fiscal structure is an institution that the ruling class uses to exact funds and wealth from the ruled class. To prevent resistance on the part of the dominated class, the elites will organize the fiscal system so to disguise the degree of wealth that is being extracted. They do this in a multitude of ways namely by obscuring the cost of government in the taxation process. Buchanan (1967) applies Puviani's works to democratic settings, whereby he notes that distinct from non-democratic societies, individuals must be allowed to "purchase" public goods and services through political institutions in a manner that is as non-distortive as possible. Wagner (1976) continues with this work, wherein he describes and reiterates how taxpayer's perceptions of the price of government can be influenced by how it is financed. He also introduces the idea that the way the financing institution is structured can affect the subsequent size of the public sector. Wagner notes that there exist four primary types of structures that can lead to fiscal illusion: 1) withholding income tax, 2) progressive taxation during inflationary periods, 3) debt finance as compared to tax finance, and 4) indirect taxation, often in the form of intergovernmental transfer and grants. These fiscal institutions, he argues, disguise the cost and consequently the size of government. Wagner and Buchanan (1977) extend this premise to argue that tax burdens will be lower under fiscal institutions that are more complex, and that taxes will likely appear more costly in simple fiscal institutions.

Fundamental to these previously presented frameworks is the Downsian (Downs, 1957) model of politicians' utility-maximization. Downs assumes that politicians are solely self-interested in maximizing the probability of being elected, so they choose to engage in actions and pursue policies that would allow them to gain the broadest level of support. He also assumes that local voters are also utility-maximizers that will vote for the politician that will maximize their net-benefit. Thus, politicians use tax and expenditure policy to attract voter support, with lower taxes and higher expenditures being assumed to be more favorably viewed and supported by voters and taxpayers than higher taxes and lower expenditures.

Paul Courant, Edward Gramlich and Daniel Rubinfeld (1979) and Wallace Oates (1979), separately develop the argument that politicians will use lump-sum grants to disguise additional spending from taxpayers, through the lens of the Downsian theory. In the former paper, the authors also assert that fiscal illusion comes specifically from the inability of voters to distinguish between the average cost that they pay in taxes for local public goods and the true marginal tax cost observed West and Winer (1980) reiterate these ideas, with particular emphasis on the tax perception concept noted in Wagner and Buchanan (1977).

One of most important causes of fiscal illusion is the “flypaper effect”. There is an area of the literature surrounding this flypaper effect (Hines & Thaler 1995, Inman 2008, Megdal 1987, Wycoff 1991). This theory can be attributed to Louise Marshall, who observed that, “money sticks where it hits.” Specifically, the theory of the flypaper effect claims that intergovernmental grants raise the cost of public observation (or the taxpayer being able to understand where money is being allocated by government), which consequently results in greater overall governmental expenditures than absent these types of transfers (Dollery & Worthington, 1995). This can also be attributed to arguments from another portion of the literature (Tiebout 1956, Oates 1972) that argues that local governments are thought to give efficiency a higher priority due to their local control and closer accountability to voters. When local governments receive all their revenues from local sources, they are more likely to be efficient. When intergovernmental grants are implemented, this accountability is thought to go away, likely leading to increases in expenditures. A model of the flypaper effect relating to the illusionary effects caused by these grants was developed by Filimon, Romer, and Rosenthal (1982). This model contrasted the median voter model presented by Downs (1957) and indicated that the median voter or average taxpayer bases their voting decisions on perceived aid and government expenditures, distinctly understanding that voters have difficulty calculating the true public expenditures and taxation levels by the various levels of government when there are intergovernmental grants or complex intertwinement of finances between different levels of government.

These studies theorize the existence of a concept that occurs in public finance called fiscal illusion, as well as a subsidiary, the flypaper effect. The consequences of these are that expenditures of government rise when taxation structures are complex. Additionally, increases occur when intergovernmental transfers are involved, reducing local accountability of funds. The following section provides a review of the empirical portion of this literature.

2.2. Fiscal Illusion: Empirical Papers

Both noted theories, the fiscal illusion and the flypaper effect, have been extensively empirically tested (Logan 1986, Misiolek & Elder 1988, Sausgruber & Tyran 2005, Turnbull 1998, Dollery & Worthington 1995). A few papers attempt to explain more generally the impact of fragmentation of governments on expenditures (Sjoquist, 1982, Schneider 1986), many of the more recent papers focus explicitly on the fiscal-illusionary effect of intergovernmental transfers (though there are other topics under the theory of fiscal illusion that have been studied, such as renter illusion, debt illusion or the revenue-elasticity hypothesis [Dollery & Worthington, 1996]). The empirical papers typically take government spending data from various levels and jurisdictions and attempt to determine whether increases in funding complexity or the implementation of intergovernmental transfers lead to increases in public expenditures or the size of government.

One of the first pieces of this literature that uses empirics to validate the hypothesis of the existence of fiscal illusion is Wagner (1976). He hypothesizes that the simplicity of the revenue structure across cities will impact total expenditure such that simpler revenue structures will lead to relative decreases in spending and finds this hypothesis to be supported. Two other papers (Breeden & Hunter 1985, Baker 1983) both replicate a similar methodology and find congruent results.

Many other studies in the same area attempt to analyze the effect of intergovernmental transfers on total public expenditures at the given level of government. These are particularly pertinent to what occurred in North Dakota, given that in North Dakota the state used intergovernmental transfers to substitute local revenue to provide property tax relief. One such paper by Winer (1983) the effect of how federal grant aid to provinces in Canada was perceived and its effects on expenditures. He hypothesized that federal grants would lead to public services being perceived at a lower tax price and being passed off to those in other jurisdictions, leading to increased overall expenditures and found his hypothesis to be accurate. Another paper (Logan, 1986) sought to analyze similar effects while including the perceived price at both the recipient (lower-level jurisdiction/state/province) and the grantor (federal) level, or the "dual-illusion hypothesis." He hypothesizes there to be an upward bias in recipient (lower level of government) expenditures and a downward bias in grantor (federal government) expenditures and finds evidence of this relationship. Finally, Dollery and Worthington (1995) attempt to test if the flypaper effect occurred in Australia intergovernmental transfers from the federal government using a similar methodology to Logan (1986). The authors in this study find similar results to the paper this was based on, providing additional validity to the theory of the flypaper effect and dual fiscal illusion.

In another vein, Grossman (1990) proposes a model in line with the Downsian (Downs, 1957) approach to politician vote maximization. He hypothesized that using fiscal illusionary tactics though intergovernmental grants will have distortionary perception effects on voters and taxpayers for politician's benefit. He analyzes the effect that the grants from the state and federal governments increase local government expenditures and found validity to his hypothesis.

Studies that analyze the effect of property relief or similar programs are also common and make up a vast portion of this literature. Brien and Sjoquist (2014) sought to discover whether state-funded property tax exemptions led to true property tax relief in Georgia's Homeowner's Tax Relief Grant (HTRG) program. The property tax exemption in the program provided a transfer from the state government to local governments to replace lost tax revenue. They find evidence that the program increases total property tax and replacement grant revenue, in addition to increasing property tax rates. Another paper (Zhao and Jung, 2008) analyzed a different property tax reduction scheme in Georgia, the LOST (Local Option Sales Tax) earmark for property tax relief. Fundamentally, the local sales tax was implemented in Georgia as an optional mechanism for local governments to offset property tax revenue. The authors test if the implementation of the LOST earmark led to property tax relief and/or increases in expenditures. Though property tax relief was observed, the increase in expenditures dramatically outpaced the relief, indicating an occurrence of fiscal illusion. A more in-depth analysis and description of this paper will be provided later as the empirical methodology used in this paper provides an excellent framework and template for the model I later will use. Deller, Maher, and Lledo (2002) conducted a similar analysis on the relationship between levels of government in Wisconsin, where local governments are highly dependent on transfers from their state government for their general operating budgets. The authors test whether these allocations are used to reduce property taxes or lead to increased expenditures and find that these state shared revenues lead to increases in local expenditures and simultaneously allows local officials to place downward pressure on property taxes.

This section provides examples of studies that present empirical evidence to the theories of relevance. They consistently find that when government revenue structures are more complex, taxes are less salient, and intergovernmental grants are implemented, government expenditures tend to increase.

2.3. Public Education Finance Restructuring/Equalization Literature

The sources where funding for public education is derived from has long been a contentious issue. Typically, states and local governments jointly fund public schools. State allocation funding formulas that have grown in popularity and implementation have usually been established with the goal of providing some degree of equalization or equity in per-pupil in expenditures so to ensure than all students, even those that come from less-wealthy districts, have the resources necessary to succeed. These formulas are structured to transfer funds from the state government to school districts to correct for variances in local property values through intergovernmental grants (Megdal 1983). There are numerous studies that attempt to estimate the impact of the reforms or intergovernmental grants on expenditure on education, funding equity, or student performance (Megdal, 1983, Wenglinsky, 1998, Craig & Inman, 1982, Park and Carroll, 1979, and Grubb & Osman, 1977). The studies summarized in this section are focused on the effects of increased expenditures given the nature of my analysis, and less-so on other areas that are focused on by the same literature.

One paper analyzed the effect of equalization policy on inequality and spending. Murray, Evans, and Schwab (1998) examined the effect of court-mandated school finance reforms from 1972-1992 on within-state school district spending inequality. They find that the reforms reduced inequality in spending across districts but also led to increases in total expenditures but needed to be funding by increasing state taxes.

Card and Payne (2002) studied the effect of the state education funding equalization reforms on the distribution of spending and test performances between these districts. They found that per pupil expenditures rose at a higher degree in states with either a court ruling for or against restructuring, as compared to states that did not have a court ruling at all. The authors also note the gap in spending between poorer and wealthier districts widened within states where a court ruling forced the restructuring of the educational finance system. Lastly, they find the increases in state government aid to lower income districts resulted in increases in relative overall spending in these districts, providing evidence for the "flypaper effect". Some of the literature has identified instances where state government transfers are not used for increases in overall spending but are substituted for reducing local property taxes, such as Lutz (2010). In this study, the author found that after New Hampshire's school finance reform in 1999, nearly all the lump-sum grant money directed to lower-income school districts was diverted away from education.

Some literature demonstrates that the type of reform has differential effects on the variance between lower and higher income areas as well as overall expenditures (Wenglinsky 1998, Jordan, Chapman & Wrobel, 2014, Roy, 2011). Jackson, Johnson, and Persico (2014) analyze state education spending at various district income levels based on their percentile of the state's income distribution. They find evidence of a causal effect of these equalization reforms on per-pupil spending, where court-mandated reforms increase spending for lower-income school districts, legislative reforms lead to overall decreases in expenditures.

The studies in this literature generally conclude that there is evidence that increases in overall expenditures due to the implementation of equalization policies, and mixed results regarding the effects of these policies on student academic performance. These findings support the theories of fiscal illusion and the flypaper effect, with similar outcomes to the literature reviewed in section 2.2.

2.4. Framework Papers

A couple of papers in the literature incorporate most of the denoted concepts of public educational finance, the flypaper effect, the impact of property tax reform and/or intergovernmental grants on expenditures. One such paper is Hartman and Hwang (1985). In this paper, the authors investigated the impact of property tax reform in Oregon on school district budgetary decisions.

In 1979, the state of Oregon passed the 1979 Property Tax Relief Plan, to reduce property tax burdens on individuals. The study was designed to identify the impact of this property tax reduction on the budgetary decisions of the school districts across the state in the year following the enactment of the policy. The authors test whether the increase in state-funding and reduction of local funding of education through the enactment of this policy resulted in increases of average per-pupil expenditures. Their results express that the policy reduced property tax levies, but additional dollars of state aid led to increases in per-pupil expenditure (though at levels lower than the reduction in property tax collections).

Plummer (2006) investigated the effects of two Texas programs, the Existing Debt Allotment (EDA) program, and the Instructional Facilities Allotment (IFA) program on reducing property taxes and increasing capital outlays, respectively. The EDA program was tested on three dependent variables: I&S taxes (taxes for debt), M&O taxes (maintenance and operations), and the combined total imposed property taxes. The results showed a decrease in the I&S tax rate, though this was offset by an equal increase in the M&O rate, indicating no noticeable impact in the overall tax rate. The results of the test for the IFA program on total capital outlay expenditures by school district indicated that the relief increased by a greater degree than if they did not receive the allocation. Lastly, Plummer tested the effect of the program on districts at various income quintiles and found that poorer districts that received funding increased capital outlays, middle-income districts that didn't receive the funding did not increase capital outlays, and that wealthy districts that did not receive funding raised property taxes to increase expenditures. The results of the study indicate that the EDA program fulfilled its goal of reducing I&S taxes, but decreases were offset by increases in the M&O tax rate, resulting in no overall tax relief. The IFA program was successful in increasing the total capital outlay expenditures per pupil.

2.5. Replication Paper: Zhao and Jung (2008)

Both studies in the previous section provide guidance to the elements required to approach my analysis as they incorporate nearly all the elements that are relevant to the policy change that occurred in North Dakota. The paper that is most relevant to my study is Zhao and Jung (2008). In this article, the authors analyze the effects of the local option sales tax (LOST) program on property tax relief (as its implementation was designed to provide for) in the state of Georgia.

The LOST program was implemented to allow local governments to enact a sales tax levy as a substitute for lower property tax revenue in the wake of 'property tax revolts.' The LOST Act, passed in 1975 and amended in 1976, mandates that local governments use the revenues collected from sales taxes authorized to be taken in through the act to roll back property taxes during the second and "all subsequent years" of its enactment. After the second year, the rollback became less certain. Due to this, the authors investigated whether the local governments used the LOST revenues in a 1-for-1 reduction in property taxes, or whether local governments supplemented their income by taking in revenue from the LOST sales taxes while reducing property taxes to a lesser degree.

The authors laid out four possible scenarios to explain the effect of property tax relief on the behavior of local governments after the implementation of LOST. In the first scenario, they predicted that the implementation of property tax relief through the LOST program would result in a reduction in property tax revenue at an amount equivalent to LOST revenue, resulting in no-change in revenue collected by the local government. In the second scenario, they predicted that the LOST revenue would simply add to the revenue taken in by property taxes and property taxes would not be cut, resulting in an overall increase in said revenue. The third scenario lies between the previous two, with some reductions in property tax revenue but not enough to overcome the total LOST revenue, resulting in an overall increase in revenue. Lastly, in the fourth scenario Zhao and Jung anticipated that the adoption of the LOST program would lead to an increase in the year-over-year rate of change in property tax revenue (that leads to increases in the same rate of change for overall revenue that includes that from the LOST program). Only one of the possible scenarios yields no increase in revenues collected, the other three did. The authors introduce the theory of fiscal illusion to explain that the change in the structure may lead to overall increases in expenditure as the complexity of the system obscures taxpayer's ability to identify how their tax dollars are collected and expended.

Zhao and Jung (2008) first hypothesized that the LOST collection would provide short-term property tax relief, but this relief does not extend into the long-term. To analyze this empirically, the authors use a pooled interrupted time-series research design on all but three of the counties in Georgia, controlling for socio-economic variables across the geographies. Three primary terms were included in the regression equation to observe the effects of the policy intervention. This was done to capture both the short and long-term effects of the LOST program on the level of property tax relief over the years of the study, 1984-2002. These three terms are: 1) the slope of the pre-intervention (long-term trend), 2) post-intervention change in slope (short-term effects of intervention) and 3) a parameter to capture the long-term effect of postintervention. The summed value of the first and the third coefficients reflect the slope of the post-intervention trend. Socioeconomic and other control variables included: per capita LOST tax revenue, per capita income, the percentage of homeownership, per capita all taxable property, per capita intergovernmental transfer revenue from both the state and federal governments, population density, unpaved miles of county roads as percentage of total county roads, and a few others. A trend term was included to indicate the years, starting at one, post 1976, where 1977 would be the number two, and so on.

The effects of the LOST program implementation on the property tax burden were analyzed using two dependent variables: per capita property tax and per capita property tax as a proportion of per capita personal income. These two variables were also analyzed on a per dollar basis with the inclusion of the per capita LOST tax revenues as a primary independent variable, providing for four separate regressions. There were several findings. First, the short-term trend variable indicated that counties increased their property tax level before the implementation of LOST and lowered them in the short term thereafter. The long-term variable showed no statistical significance, indicating that the long-term impacts of the LOST property tax relief program were inconclusive and likely kept the same trend as before the LOST intervention. Second, the analysis of the magnitudes of the impact of LOST program on property taxes showed a statistically significant negative coefficient of –0.17 on the per capita LOST tax revenue variable, indicating that the LOST revenue brings less than dollar-for-dollar relief. Lastly, the final regression showed that an increase in LOST revenue of one dollar led to increased total local expenditures by 76 cents. These results, the increase in expenditures (76 cents per dollar of LOST revenue) vastly outpacing the property tax relief (17-cent decrease in property taxes per dollar of LOST revenue), indicate that the LOST program resulted in "an augmentation of, rather than a powerful substitute for property taxes," (pg. 56). The implementation of property tax relief resulted in increased total local expenditures, providing validation to the existence of fiscal illusion in this instance. This paper also provides an excellent template for both the theoretical and empirical approaches in my analysis.

CHAPTER 3. PROPERTY TAX AND EDUCATIONAL FINANCE HISTORY AND BACKGROUND

3.1. Property Taxes

Kagan (2021) defines property taxes as those, "…paid on property owned by and individual or legal entity…" Property taxes are commonly used to finance public expenditures, especially at the local level. The process of property tax and administration and expenditure occurs differently across governments. Local jurisdictions, such as counties, cities, and school districts, have the power to levy taxes on property owned within their geographical boundaries.

Many economists favor the notion of a strong reliance on property taxes as a (or the) primary form of local public revenue collection, due to the limited distortive properties on markets these taxes have (Lemieux, Sumner, and Henderson, 2018). It is also popular among economists because it is economically efficient, given that it is hard to avoid and easily enforceable. These taxes are also thought highly of as they are perceived as socially equitable because they are at least arguably progressive, which adds to their appeal (Rosengard, 2012).

The total property tax bill that and individual must pay is calculated based on the assessed value, given by an assessor (typically from the county government), of the given property multiplied by the sum of the mill rates levied by the local governments that has jurisdiction over the property (Seabury, 2021). In 2018, U.S. state and local governments collected approximately $500 billion in revenue from property taxes, or 17 percent of total general revenue collected. Over 70 percent of all local government tax revenues come from this source as well (Skinner, 2019).[1]

[1] The other primary forms of revenue include sales taxes, individual income taxes, corporate income taxes, and charges and fees. States and localities vary dramatically on their application and reliance on property taxes as a form of revenue

Property taxes and school funding are also very closely tied in the United States; over half of all property tax revenue goes towards the financing of public K-12 education (Kenyon, 2007). The primary source of local revenues, that make up nearly half of the total education funding, are property taxes. This reliance on local government financing, and subsequently property taxes, has fallen over the past 100 years, though. In the 1919-1920 school year, over 80 percent of total revenues for education came from local sources, whereas in the 2014-2015 school year, the figure was around 45 percent (National Center for Education Statistics, 2017).

This change in the public education funding sources over time can be seen in figure 2.1.1:

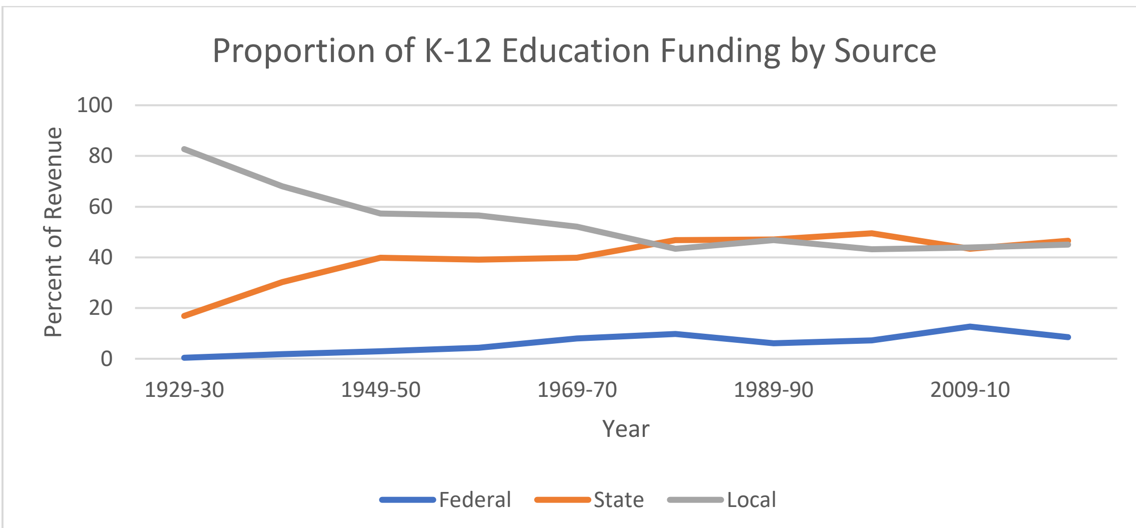

Figure 3.1. Proportion of Education Funding by Source
Source: National Center for Education Statistics

This declination of the reliance on property taxes as a form of funding may have been spurred by pushes for equalization in public education financing. Though there are many positives to using local property taxes to fund public education, such as greater local control over taxation and expenditures (Fischel, 2001), recent calls have pushed to reduce reliance on them

collection (Urban Institute, 2021). Local governments that do use property taxes to fund public services typically spend the revenues on services such as infrastructure, schools, and more (Tax Foundation, 2021).

and instead substitute with funds from higher levels of government. One of the primary concerns with relying heavily on local property taxes in the funding of public services, especially education, is the wide variance in taxes collected between jurisdictions, caused by varying property values across jurisdictions. Starting with 1971 California *Serrano* decision in the California State Supreme Court that found that wide variances in property tax bases led to constitutionally unacceptable variations is public education budgets a wave of state constitutional challenges to public education finance was ushered in. The consequence of these challenges to the existing funding structures was the implementation of funding formulas that relied more heavily on funds from the state government as opposed to property taxes. These promoted more equitable and adequate distributions of funding, where especially poor districts would typically receive more funding than they would if only property taxes were utilized (Youngman, 2016).

Not only are property taxes disliked when too greatly relied on for funding education, they tend to be one of the most unpopular forms of taxation from the perspective of the taxpayer. This is for four primary reasons: "(1) the taxation of unrealized capital gains by the property tax; (2) the fact that it is paid in large lump-sum payments by many taxpayers; (3) public anxiety about reappraisal of property values; and (4) inequitable assessments and appraisals," (Tyer, pg. 1). Property taxes are the most salient major tax because it is assessed in a lump-sum format. Tax salience is the notion that the way in which taxes are presented and displayed to the taxpayer can affect how they influence their consumption and expenditure decisions. In this light, people are more likely to change their economic behavior to highly visible and highly salient taxes, and vis-versa (Varela, 2016).

As there is generally a strong distaste for property taxes amongst property owners, who make up a large portion of the voting base, property tax relief is a common proposal for politicians and these plans are often implemented. There are a few major forms in which property tax relief can occur: 1) transfers from higher to lower levels over government so that these lower levels can reduce the burden they impose on their constituents (Stark, 1992), 2) homestead exemptions that reduce taxes on qualifying properties, 3) “circuit breakers” that target certain categories of taxpayers for relief, 4) limits placed on how much tax or mill rates can increase in a given year, and 5) expenditure or collection limit for governments (Cendella and Melnik, 2009). If expenditures are to remain constant when property tax relief is enacted, this necessitates the use of other forms of taxation to substitute for this loss of revenue.

The 2009 and 2013 legislation are examples of policies that attempted to reduce the less-desirable effects of the reliance on property taxes in the state: education funding inequity and the distaste toward property taxes by taxpayers. This was done by both implementing new models of education finance to promote equity funding (done more strongly in 2013) and enacting property tax relief simultaneously. To better understand what occurred in these polices, a background of North Dakota’s property taxes, educational funding structure, and the changes in policy that occurred due to the legislation are presented in the following sections.

3.2. North Dakota Property Tax Background and Analysis

In North Dakota, essentially all real property is subject to a property tax. This tax goes to fund local entities, such as cities and counties. No residential property tax is collected by the state government. All locally assessed property has valuations determined by each county. (Rauschenberger, 2020). The assessed value of property is the value that is reported by the county assessor for purposes of calculating the property tax bill. The taxable value is the figure the property owner pays tax on and that is used to calculate the total tax owed (Sherman, 2019).

The county government is responsible for distributing the appropriate amounts of revenue from property taxes to cities, townships, school districts and other taxing districts within the county's jurisdiction. The amount collected is based on the mill rates in the given jurisdiction. Mill rates in the state are established locally to meet the revenue needs of the district whereupon the tax is imposed (Rauschenberger, 2020). As of 2018, North Dakota imposes the property tax rate limits municipalities as displayed in table 3.2.1.

Table 3.1. Mill Limits by Level of Government in North Dakota

Level of Government	Max Mill Levy Rate
Counties	23 Mills
Cities	40 Mills
Townships	18 Mills
School Districts	70 Mills (though this can be raised with the approval of voters in the district)

Source: Lincoln Institute, 2018

Most of the property tax revenue collected in North Dakota, even as recently as in 2018, goes toward funding public education, at just under 39 percent, or right around $523 million dollars. Cities and county governments follow respectively at just over 31 percent and just under 25 percent of the revenue, respectively, and the others make up the rest. This is shown in figure 3.2.1 below.

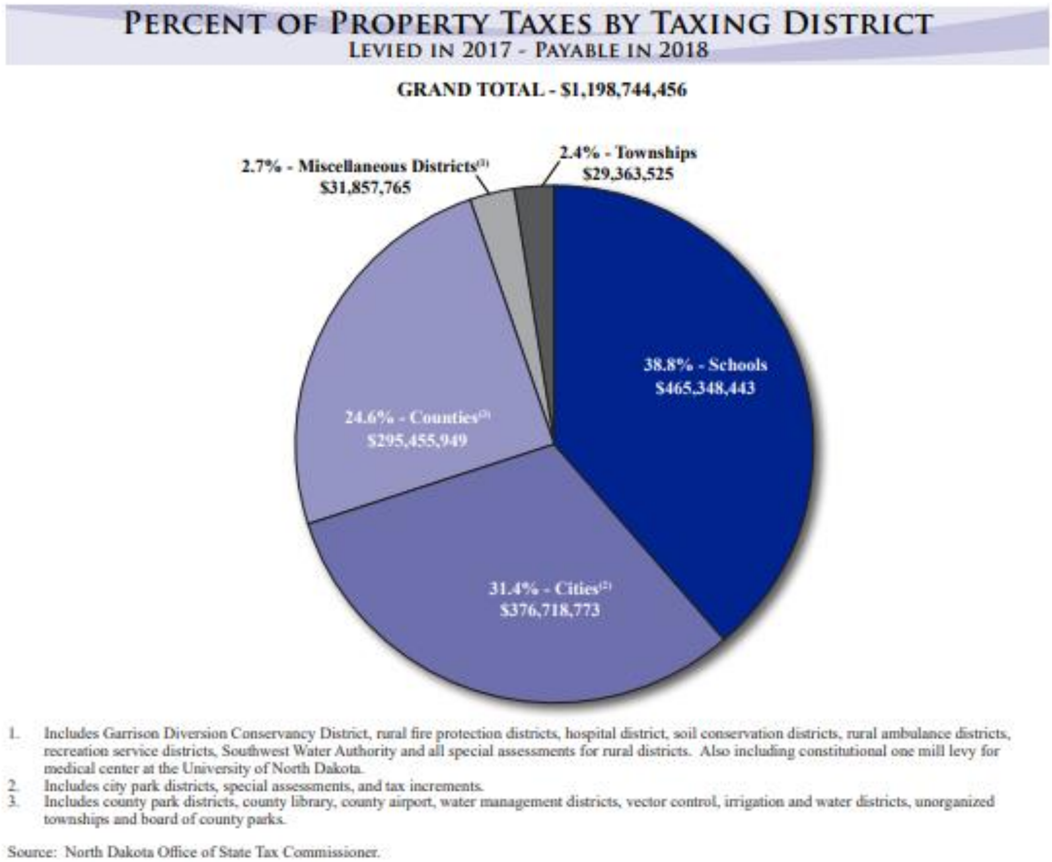

Figure 3.2. Percent of Property Taxes by Taxing District
Source: Office of the North Dakota Tax Commissioner

North Dakota has relatively low property taxes as a percentage of state and local revenue, compared to other states. A large proportion of local general revenue, as compared to other states comes from state aid (Lincoln Institute, 2018). Regardless, property tax collections throughout the state have continued to increase since 2005. School district tax collections aggregated at the county level, even with the property tax that was provided, have remained relatively constant. These trends are shown in Figure 2.2.5 below.

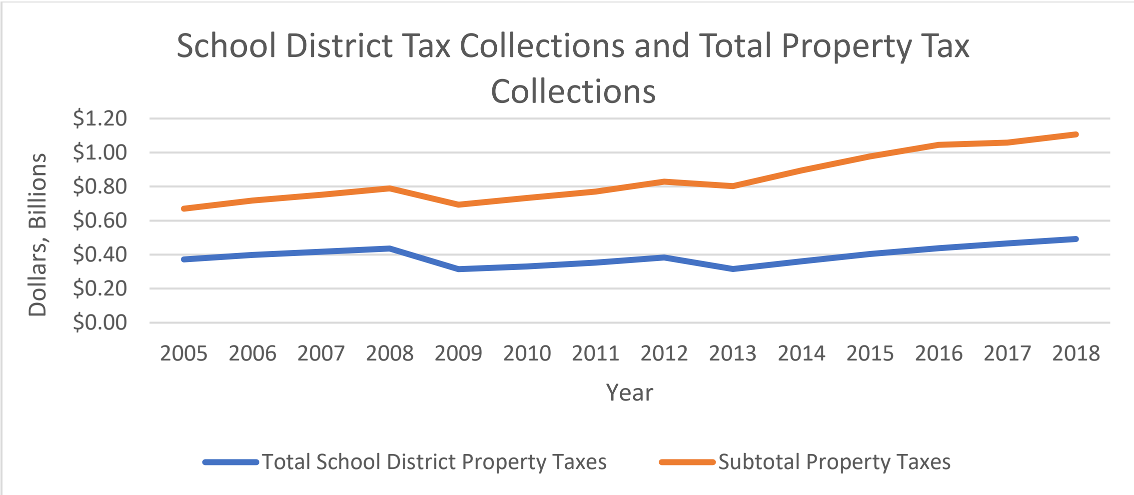

Figure 3.3. Total County Level and School District Tax Collections
Source: Office of the North Dakota Tax Commissioner

Over the time period that is relevant for this study shown in figure 3.2.2 above total school district collections noticeably dropped in 2009 and 2013 but have maintained a relatively constant level over the time period. Total property tax collections (the red line in figure 3.2.2) have risen from just under $700 million per year in 2005 to over $1.1 billion in 2018, extending the divergence from the property taxes that were collected by school districts (the blue line in figure 3.2.2). As a proportion of all property tax collections, school district collections have generally fallen over the period, as seen in the following figure, 3.2.3.

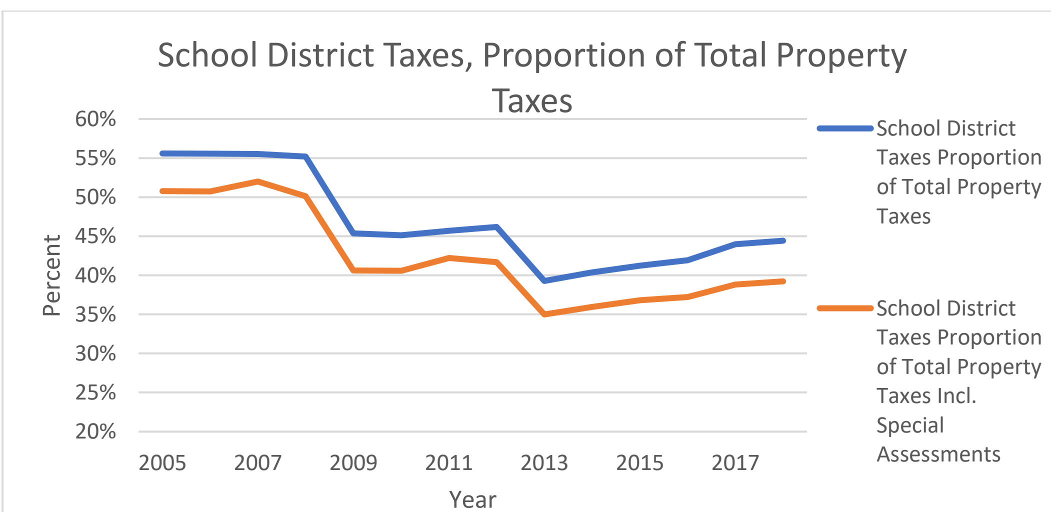

Figure 3.4. School District Property Taxes as Proportion of Total
Source: Office of the North Dakota Tax Commissioner

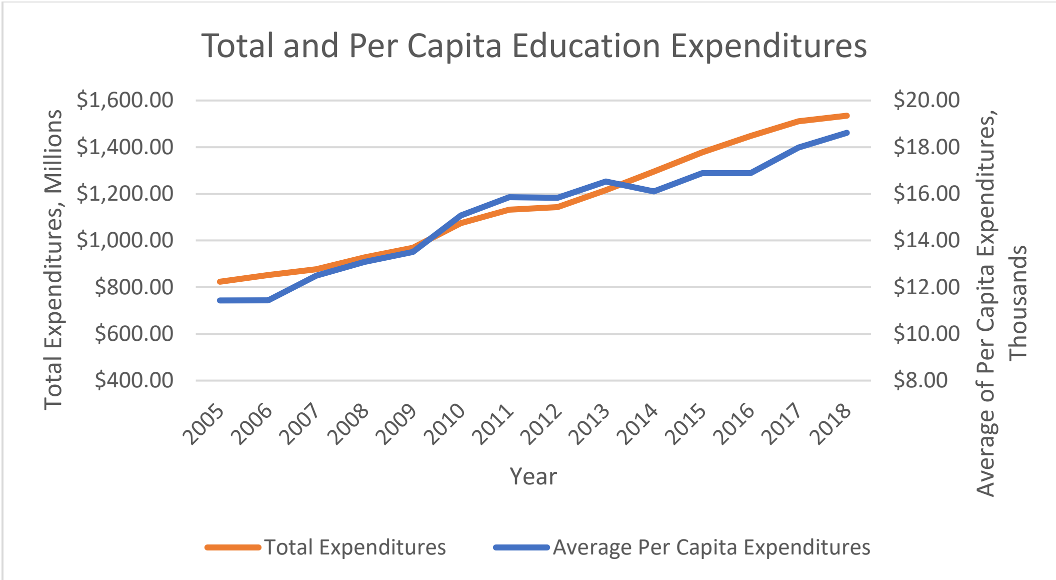

Figure 3.5. Total and Per Capita Education Expenditures
Source: North Dakota Department of Public Instruction

Figure 3.2.4 above shows the increases in both overall and per capita education expenditures that have occurred between 2005 and 2018. These previous figures, 3.2.2-3.2.4 and general history of the policy changes tell the story of a state that has decreased its reliance on property taxes as a means of public revenue collection especially for funding education, while at the same time increased total expenditures on this same expenditure.

3.3. North Dakota Property Tax and Public Education Finance History, Pre-2009

Leading up to the policy actions that took place in 2009 and 2013 that are pertinent to this study, most major policy implementations were designed to reduce the reliance public education has on property taxes and to shift the burden to the state government. Much of the reasoning behind these policies was to reduce inequities in funding that came about as a result in wide variances in property valuation, in line with what has occurred in other states and their statewide equalization programs.

State financed educational aid to local school districts first came about in North Dakota in the year 1959. During that year, the state legislature enacted a 21-mill county levy and provided state appropriations to reduce inequities between funding across districts. In addition, they attempted to reduce the ratio of the funding that came from local sources. This system was largely left unchanged into the 1960's and into the 1970's and 1980's

Legal action was taken by the Bismarck Public School District No. 1 against the state government in 1989. The suit declared that the educational finance funding model in the state was unconstitutional because of too many inequities in funding were caused by reliance on property tax revenue. In response to the ruling in opposition to the current system, the state legislature passed House Bill No. 1003 in 1993 that: 1) set state support at over $1500 per student per year, 2) raised the equalization factor, and 3) addressed inequities in the student weighting system and transportation funding system. Following the passage of this piece of legislation, the 1995-1996 Education Finance Committee conducted research that indicated that the state continued to heavily rely on property taxes to fund education.

In 2003, another lawsuit, Williston Public School District No. 1 v. State of North Dakota, was filed by multiple school districts and claimed again that the state funding model provided too few and inequitably distributed resources to school districts. The plaintiffs settled with the state, and Governor Hoeven created the North Dakota Commission of Education and Improvement by executive action in 2005 to provide recommendations to improvement of education adequacy and funding distribution equity. The commission's recommendations led to Senate Bill No. 2200, in the 2007 legislative session.

Senate Bill No. 2200 provided for a new public education funding formula that consolidated dollars from existing funding categories, established new funding weighting factors, and factored variable costs for small, medium, and large districts to limit inequity and increased allocations from the state government by nearly $100 million per year. In the next legislative session (2009), this policy trajectory continued with the implementation of House Bill No. 1400 and 1013, which increased appropriations for schools by $100 million, adjusted student weightings for the allocation formula to ensure equity and initiated several targeted programs and spending to improve quality and reduce inequity. The 2011 legislative session brought about more increases in state school aid.

3.4. Funding Structure Pre-2009 & 2013 Legislation

Prior to the implementation of the integrated funding formula in 2013, the existing formula was established during the 2007 legislative session by SB 2200 (North Dakota Legislative Council, 2019). This piece of legislation implemented a few modifications to the state public education structure and brought greater transparency to how public schools were funded. Funding continued to be based on an average daily membership (ADM) calculation for state aid allocations, but the legislation did make some small changes in the weighted student unit (WSU) structure. Previously, the state aid formula was more heavily reliant on the property wealth of each district. With its implementation, the state aid formula set a state aid allocation that the state would allocate per weighted student unit. The minimum level of per student funding was set at $3,250 for the 2007-2008 school year, and $3,325 for the 2008-2009 school year. Under this system, school districts would have the ability to generate enough tax revenue to operate from a maximum 185-mill levy on property in the district. This formula resulted in total minimum level of funding of $7,024 per pupil between both the local property tax funding and the state aid (Odden et al., 2008).

3.5. 2009 Property Tax Relief

In 2009 the first major property tax relief package was enacted in tandem with increased allocations of $92 million appropriated by the state legislature to school districts for the 2009-11 biennium. This bill, Senate Bill No. 2199, was designed to reduce property taxes, still a major funding source for public schools even after previous reforms (North Dakota Legislative Council).

Senate Bill No. 2199 provided general property tax relief to taxpayers in local school districts from the state government (North Dakota Legislative Branch, 2009a). This was done by encouraging local governments to reduce school district property tax levies by up to 75 mills and replacing the lost revenue with direct grants, termed mill levy reduction grants, to school districts from the state government. The transfer was designed to be a one-dollar for one-dollar trade-off, where property taxes were to be reduced by $295 million in tandem with the equivalent increase being allocated by the state government. The sum of the allocated money for grants (just under $300) was transferred from the permanent oil tax trust fund to the property tax relief sustainability fund for allocations over the next biennium (North Dakota Legislative Council, 2019).

In 2011, House Bill No. 1047 continued the policy of property tax relief that was authored in during the previous legislative session. The total amount of mill levy relief grant allocations were limited to not exceed the previous year's grant by more than the percentage increase in the statewide taxable valuation (North Dakota Legislative Council, 2019).

3.6. 2013 Funding Formula Change & Second Round of Property Tax Relief

Enacted in 2013 House Bill No. 1013 (North Dakota Legislative Branch; North Dakota Bill Actions: HB 1013, 2013) instituted several structural changes to the public-school funding formula in addition to integrating the previous property tax relief legislation into the funding formula. The incorporation of property tax relief into the formula meant that the mill levy relief grant program was discontinued. In its place, a funding model was implemented that allocated state aid to local school districts through state aid payments. This legislation again encouraged local school districts to drop their mill rate by additional 50 mills. The state legislature also set a base level of funding per student, based on a weighted student unit calculation per school district, to be met through the funding formula. This was initially set at $8,810 per weighted student unit. This minimum allocation calculation was the basis of how the state aid transfers were to be valued. In tandem with these changes was the implementation of a 'minimum local funding requirement'. This 'funding requirement' did not actually require that school districts set mill levies at this level as they were still permitted to tax at a lower or higher rate than this (though a mill-rate higher than 60 mills required a vote of constituents for approval), but it provided the calculation by which school aid was allocated. The state aid funding formula provided the difference between the amount calculated from applying 60 mills to local property tax valuations and the baseline per student guaranteed allocations in the form of grants to local school districts. Local governments were 'capped' at this 60-mill levy limit for property tax collections, but are allowed, "an additional 10-mill levy for general fund purposes, an additional 12-mill levy for miscellaneous purposes, and a 3-mill levy for a special reserve fund," (North Dakota Legislative Council, 2019, pg. 16).

This change in the funding formula resulted in an increase of nearly $500 million (or just under $250 mill per year) in allocations to public education from the previous biennium through the implementation of the state school aid. This resulted in the biennial appropriation growing from $1.26 billion over the 2011-13 biennium to ~$1.75 billion over the 2013-15 biennium. Specifically, the total school aid provided increased by over $175 million from the 2011-13 to just under $1.1 billion in the 2013-15 biennium. In tandem, property tax buy-downs totaled over $650 million, providing for an overall encouraged reduction of 125 mills (75 mills from the

2009-11 and 2011-13 biennia's), though local governments still had autonomy to set mill rates. (North Dakota Legislative Council, 2019). Since the implementation of the integrated funding formula in 2013, there have been few major structural changes to the funding formula and property tax relief.

3.7. School District Mill Levy Limitations and Background

Before 2009 and the implementation of the first round of property tax relief, the maximum mill levy for general fund collections was set much higher than after 2009 and after 2013. The timeline for the changes in the maximum mill levies per school district are as in table 3.7.1.

Table 3.2. Maximum General School District Mill Levy by Year

Time	Maximum Mill Levy	Explanation
Pre-2009	185 mills	Maximums were set at 185 mills. School districts with populations less than 4,000 people could approve higher rates with 55% approval. Increases in total dollar collections were capped at 12 percent annually (Fong, 2009).
Post 2009, Pre 2013	185 mills, though encouraged down to 110 mills	Maximums were still left at 185 mills, though to receive the mill-levy reduction grant allocations from the state government maximum mills had to be brought down to 110 mills. The mill-levy reduction grants were first to be applied to the general fund mill rate, then the high-school tuition levy, and then the high school transportation levy. School districts with populations under 4,000 were still allowed to increase total collections per the same mechanism (Fong, 2009).
2013	82 mills	After the implementation of the Integrated Funding Formula, the maximum mills were capped at 82 mills for the 2013 taxable year only (Fong, 2013)
Post 2013	70 mills, though could impose higher with approval of district	After 2013, the maximum number of mills school districts were allowed to impose was 70. The 12 percent maximum annual increase in collections was continued over the entire time period (Rauschenberger, 2015). Districts were still allowed to charge more, but this would require permission via a vote of the populous of the school district. For the calculation of the integrated funding formula payments, the mill limit is lower at 60 mills. As of 2018, 66 school districts levied below 60 mills, 104 school districts levied between 60 and 70 mills, and 8 school districts levied above 70 mills (Tescher, 2018).

The levy limitations that were lowered because of the policy changes from 2009 to 2013, apply only to General Fund Levies. There are other classifications of levies, such as those shown in the following table 3.7.2:

Table 3.3. Max Mill Rate by Type of School District Levy

Type of Levy	Max Levy Rate	Number of School Districts using to Raise Revenues
Miscellaneous Levy	12 Mills	101
Building Levy	20 Mills	138
Sinking and Interest Levy	No Limit	56
Tuition Levy	No Limit	36
Special Reserve Levy	3 Mills	61

Source: Tescher (2018)

The average school district mill rates decreased from 2005 through 2019, as anticipated from 2009 and 2013 legislation. This can be seen in figure 3.7.1 below.

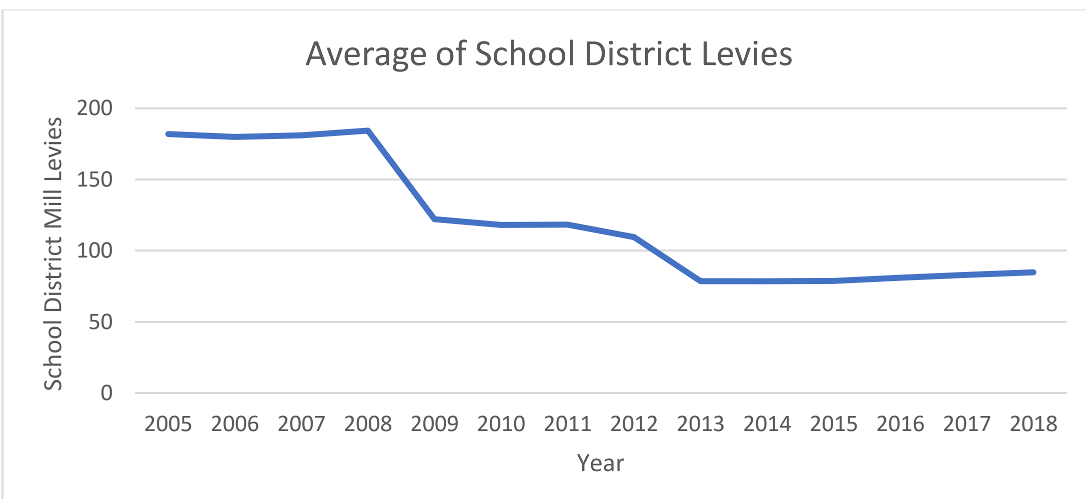

Figure 3.6. Average of School District Mill Rates by Year
Source: North Dakota Department of Public Instruction

Noticeably, mill rates declined significantly between 2008 and 2009, when the first property tax relief package was implemented, and as well between 2012 and 2013, when the second relief package went into effect. This figure shows that both property tax relief packages led to significant declinations in the average assessed mill rate for school districts in the year of the implementation of each policy.

3.8. Review and Summary of Major Policy Changes and Effects

A summary of the major policy changes and their plausible effects are presented in the appendix in table A.1.

The implementation of these policies both coincided with and contributed, at least in part, to the coinciding increase in both total and per pupil K-12 education expenditures in the state. Between 2005 and 2018, total state expenditures on education increased from just over $800 million to over $1.5 billion or an increase just under 90 percent. During this time, enrollments only increased from over 102 thousand to 112 thousand, or a 9.6 percent increase. A chart of the total values and the differenced values per year are below in figure 3.8.1 and figure 3.8.2 respectively.

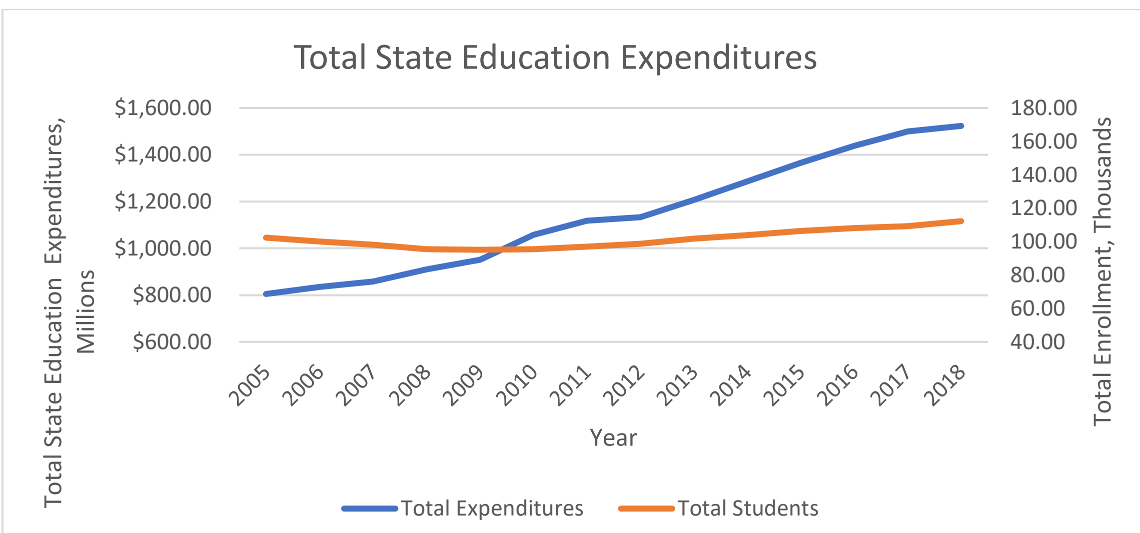

Figure 3.7. Total Expenditures and Enrollment, 2005-2018
Source: North Dakota Department of Public Instruction

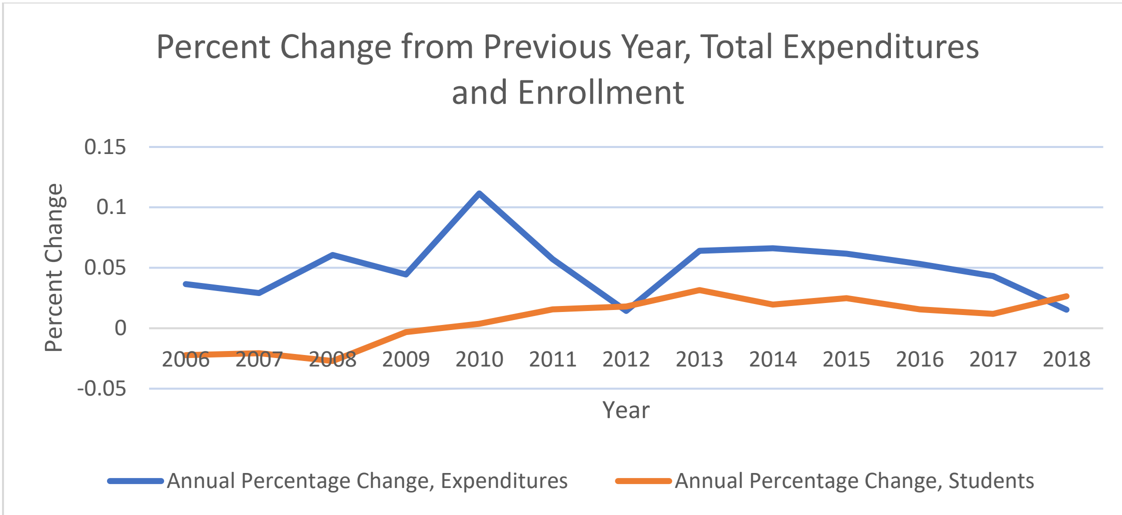

Figure 3.8. Annual Rate of Change, Total Education Expenditures and Enrollment, 2005-2018
Source: North Dakota Department of Public Instruction

Figure 3.8.1 shows a growth in expenditures that appears to outstrip the proportional growth in enrollment. Figure 3.8.2 validates this, showing that over the given period, the growth rate of expenditures dramatically grew faster than the rate of growth in enrollment. The annual percentage change (from the previous year) in expenditures is higher in nearly every year than the annual percentage change in students. This indicates that per pupil expenditures increased over the time period and validates my assumption. This growth in per pupil expenditures from 2005 through 2018 is seen in figure 3.8.3 below.

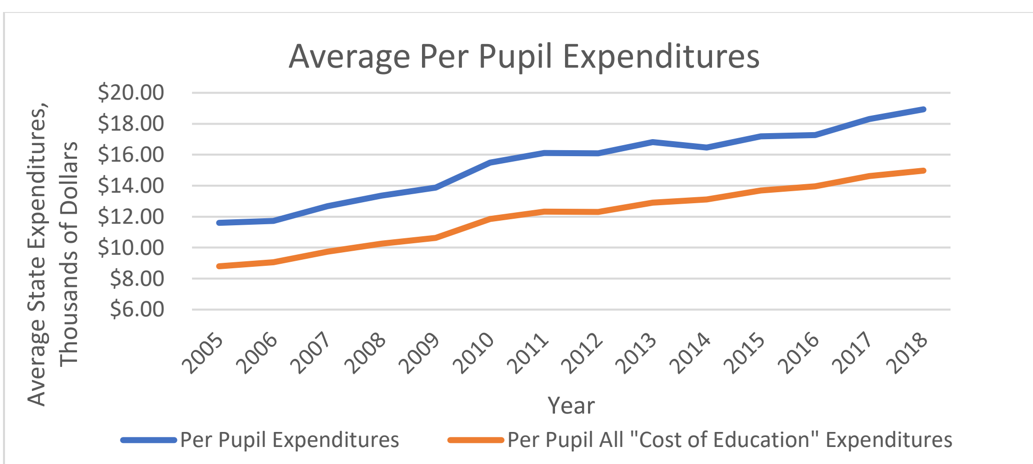

Figure 3.9. Per Capita Expenditures, 2005-2018.
Source: North Dakota Department of Public Instruction

Some of this increase seen in figure 3.8.3 above can be attributed to explicit increases in allocations by the state government to education. It is not clear, though, that all of it can as a portion of education funding still comes from local school district property taxes. The empirical portion of the study is dedicated to deciphering the relationship between property tax relief, the implementation of the new funding formulas and the increases in per pupil expenditures and attempting to identify there was an occurrence of fiscal illusion that was caused by the implementation of the 2009 or 2013 legislation. Property tax relief and the degree of reduction is the instrument by which fiscal illusion can be identified, as the degree of property tax relief is indicative of how much new state government money is being allocated to the school district, providing the opportunity for expenditures to increase to a degree greater than accounted for or anticipated.

CHAPTER 4. MODEL AND DATA

4.1. Empirical Model

The model I utilize to analyze the effect of the property tax relief on per capita education expenditures to attempt to identify an occurrence fiscal illusion is based on Zhao and Jung (2008). Due to better data availability with access to mill rate and intergovernmental grant values that Zhao and Jung did not have, I can control for the effect of the policy implementations in a more sophisticated and likely accurate manner than in their study. Thus, my model does not incorporate the time-trend variables as was done in their study. Instead, my model incorporates variables that are tied more directly to the realized effects of the property tax relief in dollar or mill rate terms.

The model utilizes the level of property tax relief, either as part of the 2009 or 2013 legislation, as the instrument wherein the fiscal illusion can be identified. By reducing the property tax burden by replacing these revenues with increased intergovernmental transfers and grants can lead lower tax salience (or increase the costs of inquiry into the funding structure) and produce an opportunity to hide additional expenditures (Dollery & Worthingon, 1995), whether through increased grant aid or other means. Local governments, school districts included, are thought to give efficiency a higher priority in their revenues come from local sources (Tiebout 1956, Oates 1972), so increasing state aid provides a lower incentive to be efficient in expenditure. Thus, I hypothesize that the degree of property tax relief that occurred increased per pupil expenditures by a greater degree due to their increased ability to disguise (whether intentional or not) the revenue collected, leading to an ability to increase expenditures by a degree more than was accounted for.

The estimation equation for the model is written below with β_1 being the coefficient for PropTaxRelief1Allocation, β_2 being the coefficient for PTR2Dummy, and β_3 being the coefficient for PropTaxRelief2County, or PropTaxRelief2SchoolDist. β is the coefficient for the vector of control variables $\boldsymbol{x}_{it}$, γ_t is the time effect[2], δ_i is the state fixed-effect, and ϵ_{it} is the error term. This is formally presented below:

$$y_{it} = \beta_1 PTR1 + \beta_2 PTR2Dummy + \beta_3 \text{PropTaxRelief2SchoolDist} + \beta\boldsymbol{x}_{it} + \gamma_t + \delta_i + \epsilon_{it}$$

This model used is a panel fixed-effects regression. PropTaxRelief1Allocation represents the property tax relief that occurred in 2009, and PropTaxRelief2SchoolDist represents the property tax relief that occurred in 2013. The analysis occurs at the county level, where there are 53 counties in the state, to allow for the county level variation to be relevant in the model. School districts and counties are not identical in how they raise and spend taxes, nor were they identical in how they reacted to the property tax relief. I allow for the observance of the distinct policy conditions of the counties, unit fixed effects are employed. Fixed effects regression allows for the observance of county specific effects that might be unobservable in the data collected or the model specification (Hausman and Taylor, 1981). Specifically, it accounts for variation in the data which is constant across time by unique to each county. As counties and school districts operate independently and have differing populations, economic makeups and public finance structures, it is necessary to correct for the unobserved unique county level effects in the data, thus fixed effects are preferred in the analysis, so long as the Hausman determines this to be the case. The Hausman specification test used to determine the appropriateness of fixed or random effects was conducted, and the fixed effects approach was found to be appropriate. As the data incorporates time, testing for autocorrelation is also necessary. Wooldridge test for serial

[2] For two-way fixed effects regressions.

correlation is conducted (Drukker, 2003), and no first order autocorrelation is found for all models. Thus, I can be confident standard errors are not biased, and that my regressions are efficient. All the models run incorporate robust standard errors to control for and correct heteroskedasticity.

Time fixed effects are also employed, resulting in what is considered two-way fixed effects. The method of two-way fixed effects has become one of the primary methods of estimating and deriving causal inferences from panel data. This approach allows for increased accounting for unobserved confounders for both time-effects, wherein an exogenous treatment (e.g., a new policy implementation or approval of new, additional expenditures) may occur, and unit-effects, as explained previously. “The inclusion of unit and time fixed effects accounts for both unit-specific (but time-invariant) and time-specific (but unit-invariant) unobserved confounders in a flexible manner,” (Imai and Kin, 2020, pg. 2). The incorporation of time fixed effects will help to account for any possible increases, decreases, one-time grants or changes in state or local education funding that are not able to be incorporated into the base structural model. This also helps to control for the effect of increases in expenditures that occurred in the years during and prior to PropTaxRelief1Allocation, that could not be accounted through the implementation of a dummy variable as was done through PTR2Dummy for the second legislative package. This results in the same structural model as previously provided, but with the time-effect, γ_t, being a fixed effect as well. This is implemented by the incorporation of time-dummies, one for each year. One year is excluded to prevent collinearity.

I borrowed from Zhao and Jung the approach to measurement of the effect of the policy intervention. In their study, the authors test to see if the implementation of the LOST policy increased local government expenditures. They used time-trended instruments to identify and control for the effects of declination in property taxes relative to the increases in local expenditures that occurred. I borrow large portions of this approach by using instruments such as the average mill levy reduction post-2013 legislation, the total county intergovernmental grant receipts per year from the 2009 legislation to account for the declinations in property taxes. I also use instruments such as two-way fixed effects and a dummy variable, PropTaxRelief2Dummy, to account for the implementation of the brand new funding formula in 2013 and subsequent expectations in expenditure growth. The dependent variable measurement I use is similar theirs as well. They used a per capita local government expenditures variable at the county level. I used per pupil education expenditures variable at the same level of analysis. The only large distinction in my empirical approaches to estimation is Zhao and Jung's use of time-trended variables, and my ability to find valid instruments given varying data availability and slight distinctions in programs implemented.

The use of the data and the implementation of unit fixed effects at the county level of analysis may pose some concerns. Local school districts have at least some autonomy to set the mill levy rate assessed on property in their jurisdictions. Aggregating the data to the county level eliminates some of the heterogeneity in variance that may exist between the behavior of school districts. Nevertheless, aggregation was necessary in this instance to be able to implement meaningful control variables in the analysis. Data is sparsely available at the school district level, so essentially none of the control variables could be meaningfully implemented at the school district level. Not being able to use any control variables in the construction of a model dramatically reduces the validity of the findings. Though a difficult empirical decision, I decided to conduct the analysis at the county level due to the inability at the school district level to implement nearly any controls. In addition, since this is study is not designed to provide policy recommendation and is rather a study that is using empirics to attempt to identify and occurrence of fiscal illusion, conducting an analysis where there is less unit-level variation does not detract from findings as increased variation would likely be more explanative. If results are statistically significant at the county level, I can have confidence fiscal illusion exists. Iterations of the model are also run at the school district level without controls and are included in the appendix in table A.2. The regressions run and presented in the appendix serve as a robustness check on the iterations run in the model. The findings are consistent with those for the county level of analysis, providing validity to the results seen at the county level.

4.2. Data

To test the effects of property tax relief on education expenditures in North Dakota, this study utilizes school finance, property tax related and demographic and socioeconomic variables calculated at the county level. Much of the data is calculated and listed at the school district level. Essentially all the control variables were not available at this level of analysis, and rather at the county level. To aggregate to the county level, school districts were sorted into the counties they reside in. Variables were summed (for all raw values) and averaged (for variables that were on a per capita basis or similar) across the school districts residing in the given county to result in final values for county for the given year. The dependent variables used in my analysis are the cost per pupil for all expenditures (CostPPExp) and the cost per pupil for all education expenditures (CostPPAllEducExp). These variables are defined by the North Dakota Department of Public Instruction as "cost per-pupil for all expenditures", and "cost of education expenditures," respectively. These variables are used instead of overall net expenditures as these control for the size of the school district. Not using these may skew the findings. They were initially set at the school district level of analysis but are averaged to the county level.

The primary independent variables used to identify the impact of the two policy interventions on per-student expenditures were one variable for the 2009 property tax relief and two for the 2013 property tax relief and integrated funding formula. The total mill levy reduction grant allocations to local school districts from the first round of property tax relief is denoted as PropTaxRelief1Allocation. This variable is in the form of raw dollar amounts of allocation to each school district for each of the years 2009-2012 and summed for each year to the county level. This variable was adjusted on a county per capita basis as well as a county per pupil basis was created by dividing the value by both the county population and the number of students in the county, respectively. Both dependent variables were regressed in all of the presented iterations of the models. The results from these regressions were not different in any meaningful way from the results from simply using the raw allocation about, so the unadjusted PropTaxRelief1Allocation is used for simplicity. The implementation of the second round of property tax relief that occurred in 2013 was tied to the implementation of the integrated funding formula. As I expect increases in expenditures due to this given the increase in per-pupil minimum funding level that was implemented, a dummy variable was generated for the years wherein this policy was in-place. This variable is labeled PTR2Dummy. The final primary independent variable in the model is designed to account for the degree of property tax relief that occurred due to the second policy implementation. Raw dollar amounts of property tax relief were not able be attained given the elimination of the mill levy relief grant program and the implementation of the new state aid funding system, so the reduction in mill levies that occurred in each school district as a result of the policy is used. The variable used to model this was developed by subtracting the average mill rate assessed at the county level in the given year by the mill level value in the year prior to the policy implementation. The mill levy rates in each subsequent county in the years 2013-2018 were subtracted from the mill levy rate in 2012. These values were then multiplied by the value negative one for interpretability. This resulted in nearly all positive values, as the mill rates consistently declined in the years following 2012. This variable is labeled PropTaxRelief2County. This variable is used to see if fiscal illusion could be observed at the county level of analysis as this is the level of analysis control variables were available and analysis at the county level is common in the literature. Additionally, it was another measure of property tax relief available to me to test given that overall average mill rates at the county level (which school district level mills were a subcomponent of) declined due to the property tax relief enacted. A similar variable was developed in the same manner from school district level general levy data as the average mills assessed are available at school district level as well. This variable is labeled PropTaxRelief2SchoolDist. This variable has less statistical noise than PropTaxRelief2County, as it only includes calculations related to the school district level, and not the county level. In 2009, $100 million in additional dollars were allocated from the state legislature to increase ‘equity’. In the previous biennium in 2007, $92 million additional dollars were allocated. The implementation of another dummy variable to account for this as was done for PTR2Dummy is not feasible as doing so may result in collinearity issues. Instead, these increases in expenditures are accounted for with the use of two-way fixed-effects as the use of this method accounts for exogenous time-variant factors that may influence dependent variable.

Much of the data utilized in this analysis comes from the North Dakota Department of Public Instruction. Demographic and socioeconomic variables come from U.S. federal government sources such as the Bureau of Economic Analysis and the U.S. Census Bureau. Educational Attainment and Median Housing Price variables are available beginning in 2010, so a linear extrapolation procedure was employed to generate values for each county for the missing years. Regressions only included variables that were extrapolated. None of the variables that required extrapolation were included in their original form. Property tax data comes from the office of the North Dakota Tax Commissioner. All data sources are given in the summary statistics table 4.2.1. I was able to collect data at the county level for the years 2005 through 2018. This provides an adequate number of years before and after the policy interventions to conduct a meaningful analysis.

The control variables denoted above are designed to control for factors of variation between counties that are relevant to factors that influence either property taxes or the amount residents may vote to spend on local education. In addition, they are largely replicated from those from Zhao and Jung (2008).

Table 4.1. Variable Descriptions

Variable	Definition	Source
CostPPExp	Cost per pupil for all expenditures averaged by school district at the county level	North Dakota DPI
CostPPAllEducExp	Cost per pupil for all "Cost of Education" expenditures, averaged by school district at the county level	North Dakota DPI
StaffPPExp	Summed value of total instructional and support staff salaries, divided by school district K-12 Enrollment, averaged by school district at the county level	North Dakota DPI
AdminPPExp	Summed value for total school administration and general administration, divided by school district K-12 enrollment, averaged by school district at the county level	North Dakota DPI
CapOutlaysPPExp	Expenditures on capital projects divided by school district K-12 enrollment, averaged by school district at the county level.	North Dakota DPI
PropTaxRelief1Allocation	Value of allocations in thousands of dollars granted to school districts for property tax relief from the state government through Mill Levy Reduction Grants	North Dakota DPI
PropTaxRelief2Dummy	Dummy variable for the years where the Integrated Funding Formula was in place (2013-2018)	Generated Dummy Variable
PropTaxRelief2County	Mill Rate reduction values derived by subtracting the total averaged county mill rate in the given year by the value in the year 2012. The variable is multiplied by -1 to make the values positive for interpretation.	The Office of the North Dakota Tax Commissioner
PropTaxRelief2SchoolDist	Mill Rate reduction values derived by subtracting the total school district general levy mill rate (averaged to at the county level) in the given year by the value in the year 2012. The variable is multiplied by -1 to make the values positive for interpretation. The variable used to calculate this is the summed value of all of the levies (General Fund, Building Levy, Tuition Levy, etc.).	North Dakota DPI
PropTaxRelief1MillReduction	Mill Rate reduction values derived by subtracting the total school district general levy mill rate (averaged to at the county level) in the given year by the value in the year 2008. The variable is multiplied by -1 to make the values positive for interpretation.	North Dakota DPI
K12Enrollment	Total K-12 enrollment per school district, summed to be at the county level.	North Dakota DPI
PerCapitaIncome	Per Capita income of population in given year	U.S. Bureau of Economic Analysis
PropTaxPercentPersonalIncome	Total property taxes collected by county divided by the total personal income value for the county.	The Office of the North Dakota Tax Commissioner and U.S. Bureau of Economic Analysis
TaxValTotalPop	Total Taxable Valuation in the county divided by the total population by each given year	U.S. Census Bureau and the Office of the North Dakota Tax Commissioner
MedianHouseValue	Median owned housing value by county	U.S. Census Bureau American Communities Survey
HomeOwnRate	Home ownership rate by county	U.S. Census Bureau American Communities Survey
PercentBachDegree	Percent of population that has attained a bachelor’s degree or higher	U.S. Census Bureau American Communities Survey

Values for the years 2005-2009 for the variables MedianHouseValue, HomeOwnRate, and PercentBachDegree are developed using linear extrapolation from the latter years of data.

Total K-12 Enrollment (K12ENR) per district is included as enrollment in a district can influence per capita expenditures, given possible marginal returns to scale for larger school districts as opposed to smaller. Though the dependent variable is measured in per pupil, total enrollment can have marginal effects on expenditures per pupil. Per capita income (PerCapitaIncome) is included as the wealth of a county or school district is thought to be influential in how much funding taxpayer are willing and/or able to give to education. Property taxes as a proportion of personal income (PropTaxPercentPersonalIncome) is included to control for variances in how much individuals actually pay in property taxes on average at the county level, which could influence per capita education. expenditures. Per capita total taxable valuation (TaxValTotalPop) is included as taxable valuation can influence the amount of taxes collected and the median owned hosing value (MedianHouseValue) is included to control for variances in housing prices, that may influence how much property tax is collected in the county. Finally, the 4-year college degree attainment rate (PercentBachDegree) and the homeownership rate (HomeOwnRate) are included as in previous studies, these homeownership rates and educational attainment are positively associated with the use of property taxes (Zhao and Jung, 2008). Zhao and Jung (2008) included a few other variables which are not relevant for this study, as well as a few variables that were not able to be collected for the level of analysis over the utilized timespan. One variable that I collected but is not included in the analysis is the population density in the county. This variable was removed due to collinearity concerns with the K12Enrollment variable.

The summary statistics for the data used in this analysis are presented in table 4.2.2. below. The first five variables at the top of the table are the dependent variables used in the model. The top two are the primary variables used as they are the most wholistic variables estimating the full cost of education per pupil, the second being a slightly more defined subcomponent of the first. The following three are components of the above two and are used simply for further investigative analysis. Notably the variables that attempt to calculate the level of relief induced due to reductions in mill levies (PropTaxRelief2County & PropTaxRelief2SchoolDist) have smaller means than that the expected reduction in mills. This is due to the variables having the value of 0 before the year of implementation of the policy (and after 2012 in the case of PropTaxRelief1MillReduction). None of the variables provided have surprising variances or outliers, providing confidence in the data used.

Table 4.2. Summary Statistics

Variable	N	Mean	St. Dev	Min	Max
Dependent Variables					
CostPPExp	742	15,756	7,210	4,941	78,114
CostPPAllEducExp	742	12,331	5,127	4,052	54,174
StaffPPExp	742	7,747	2,612	3,585	26,585
AdminPPExp	742	1,785	816.9	402.1	6,414
CapOutlaysPPExp	742	174.2	461.7	-43.18	4,520
Independent Variables					
PropTaxRelief1Allocation	742	963,173	3.679e+06	0	4.582e+07
PropTaxRelief1MillReduction	742	19.24	32.09	-2.3	118.91
PropTaxRelief2Dummy	742	0.429	0.495	0	1
PropTaxRelief2County	742	18.59	26.71	-18.88	111.9
PropTaxRelief2SchoolDist	742	11.13	17.29	-43.96	62.98
K12Enrollment	742	2,188	3,949	13	30,677
PerCapitaIncome	742	46,612	13,293	17,588	102,223
PropTaxPersonalIncome	742	0.0323	0.0110	2.80e-05	0.0947
TaxValTotalPop	742	5,716	3,282	495.8	20,152
MedianHouseValue	742	88,370	41,376	-1,200	256,000
HomeOwnRate	742	74.45	9.375	39.50	102.8
PercentBachDegree	742	19.64582	6.261967	-9.4	39.4

The first five variables at the top of the table are the dependent variables used in the model. The top two are the primary variables used as they are the most wholistic variables estimating the full cost of education per pupil, the second being a slightly more defined subcomponent of the first. The following three are components of the above two and are used simply for further investigative analysis.

CHAPTER 5. EMPIRICAL RESULTS

This chapter will present the results of the empirical tests laid out in the previous section. The results will be presented such that each subsection is a separate iteration of the model. Each model presentation for the two primary dependent variables of concern, CostPPExp (per pupil all expenditures) and CostPPAllEducExp (per pupil all "cost of education" expenditures), will have iterations with and without controls and with one- and two-way fixed effects, in addition to being run with OLS. OLS is utilized to allow comparison of model fit with the one and two-way fixed-effects models. This is done to provide context to the various model fits as justified in section 4.1. The later models (with dependent variables CAPEXPPP, ADMEXPPP, and StaffPPExp, and the robustness checks) will only be presented with control variables and one and two-way fixed effects. Each set of results will have either one of PropTaxRelief2County (county level property tax relief) or PropTaxRelief2SchoolDist (school district property tax relief) as independent variables. These variables are structured in the same manner but are concerned with two different levels of observation. All the regressions include the PropTaxRelief1Allocation and PropTaxRelief2Dummy terms, with PropTaxRelief2Dummy notably being a control variable. The PropTaxRelief1Allocation (the total aid allocation) term is divided by 1000 for ease of interpretation, given the status of the variable being in nominal dollar terms, and is presented as PropTaxRelief1AllocationT in the regressions to signify that the variable is adjusted in this manner. Models with each dependent variable are run with both (though not at the same time) of these two variables to test robustness.

5.1. Reduction in Average County Levies on Cost of Education

This subsection will focus on the results of the county fixed-effects regressions where the reduction in average county mills is the variable used to model the extent second round of property tax relief, and the allocations provided to school districts being the variable to model the first round of property tax relief, being regressed on the cost-per-pupil expenditures and "cost of education expenditures" in the following two tables respectively.

Table 5.1. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2Count on CostPPExp

Models	(1) OLS	(2) OLS w/ Controls	(3) Fixed Effects	(4) Fixed Effects w/Controls	(5) Two-Way Fixed Effects	(6) Two-Way Fixed Effects w/Controls
PropTaxRelief1Allocation T	-0.0264	0.00910	0.158***	0.0937**	-0.0244	-0.0459
	(0.0688)	(0.0672)	(0.0502)	(0.0375)	(0.0415)	(0.0422)
PropTaxRelief2Dummy	6,705***	-2,240**	3,060***	537.5	8,027***	10,710***
	(882.3)	(962.6)	(1,069)	(1,026)	(1,833)	(2,097)
PropTaxRelief2County	-69.18***	19.94	22.46	42.29**	8.911	29.36
	(16.20)	(14.94)	(17.83)	(20.88)	(19.86)	(19.70)
PropTaxPercentPersonalIncome		-268,904***		34,000		101,521
		(28,569)		(69,973)		(84,483)
K12Enrollment		0.146*		-0.0380		-0.0304
		(0.0858)		(0.117)		(0.0989)
PerCapitaIncome		-0.140***		0.113**		0.0187
		(0.0275)		(0.0549)		(0.0406)
TaxValTotalPop		2.091***		0.495*		0.192
		(0.138)		(0.284)		(0.264)
MedianHouseValue		-0.0296***		-0.0293		-0.0511***
		(0.00876)		(0.0176)		(0.0183)
HomeOwnRate		-51.04*		98.32		93.10
		(28.65)		(74.53)		(62.35)
PercentBachDegree		-20.26		-53.99		-134.6*
		(44.45)		(60.90)		(69.36)
Constant	14,253***	26,115***	13,923***	1,934	11,293***	4,509
	(361.4)	(2,465)	(209.9)	(7,490)	(364.8)	(5,957)
Observations	742	742	742	742	742	742
R-squared	0.087	0.348	0.200	0.280	0.336	0.394
Number of Counties			53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The above table shows promising and expected results. The OLS regression results show little significance, but the one-way fixed-effects regression results, especially with controls, shows some validation of the anticipated hypothesis. PropTaxRelief1Allocation is positive and significant, PropTaxRelief2Dummy is positive as expected, and PropTaxRelief2County is positive and significant. This indicates that, within this model specification, PropTaxRelief1Allocation led to increases in per capita education expenditures where the greater the property tax relief the greater the per pupil expenditures on education. A one-thousand dollar increase in the mill levy grant appropriated would increase per pupil student expenditures by about around 10 cents. This may seem insignificant, but the average grant value is 963,173. PropTaxRelief2County, the reduction in county mill levies after the implementation of the second round of property tax relief, is positive and statistically significant at the ten percent level, indicating that the greater the reduction in mill levies, the greater the expenditures on education, where a decrease in 1 mill would lead to an increase of approximately $38 per capita. The incorporation of two-way fixed effects, which is the model specification that I ultimately place greater emphasis on, dramatically reduces the statistical significance for the primary independent variables in the model. The improvement of the R-squared value when time fixed effects are included indicates that time effects are important in explaining the variance in the dependent variable. With these time effects, neither of the two primary independent variables, PropTaxRelief1Allocation or PropTaxRelief2County are statistically significant. In contrast, PropTaxRelief2Dummy is positive and statistically significant at the one percent level, which is expected given its status as a dummy that is built to explain the expected increase in expenditures following the implementation of integrated funding formula. This is intriguing, as both were significant without time fixed effects. Utilizing PropTaxRelief2SchoolDist in the second set of results may impact this, as this variable is a more precise indicator of the degree of property tax relief, given that the observations occurred at the school district level, where the reductions actually occurred. These results are mixed, with some indication of the expected effect from both rounds of property tax relief but not clear causal effect after the incorporation of time fixed effects.

The results from the next regression with the dependent variable simply switched to only include "cost of education" expenditures are in the below table, 5.1.2.

Table 5.2. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2County on CostPPAllEducExp

Models	(1) OLS	(2) OLS w/ Controls	(3) Fixed Effects	(4) Fixed Effects w/Controls	(5) Two-Way Fixed Effects	(6) Two-Way Fixed Effects w/Controls
PropTaxRelief1AllocationT	-0.0459	0.0127	0.114***	0.0634***	-0.0259	-0.0422*
	(0.0476)	(0.0466)	(0.0341)	(0.0203)	(0.0215)	(0.0248)
PropTaxRelief2Dummy	5,379***	-548.8	2,794***	945.4	6,689***	8,982***
	(610.5)	(666.7)	(718.0)	(601.1)	(1,293)	(1,443)
PropTaxRelief2County	-50.36***	12.65	15.83	27.53**	4.124	15.19
	(11.21)	(10.35)	(12.12)	(13.67)	(13.40)	(12.21)
PropTaxPercentPersonalIncome		-191,078***		-4,603		39,377
		(19,787)		(40,761)		(51,812)
K12Enrollment		0.0807		-0.00200		0.00378
		(0.0594)		(0.0887)		(0.0713)
PerCapitaIncome		-0.101***		0.0555*		-0.0136
		(0.0190)		(0.0288)		(0.0232)
TaxValTotalPop		1.424***		0.393**		0.140
		(0.0957)		(0.193)		(0.174)
MedianHouseValue		-0.0218***		-0.0153		-0.0340***
		(0.00607)		(0.0110)		(0.0111)
HomeOwnRate		-29.93		73.89		69.63*
		(19.84)		(47.94)		(38.61)
PercentBachDegree		-44.44		-16.91		-74.47
		(30.78)		(40.00)		(46.36)
Constant	11,037***	19,935***	10,751***	2,877	8,659***	5,086
	(250.0)	(1,707)	(149.8)	(4,723)	(291.3)	(3,963)
Observations	742	742	742	742	742	742
R-squared	0.124	0.373	0.276	0.346	0.425	0.474
Number of Counties			53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the test of this model are nearly identical to the previous model, with some improvements in the R-squared values and some slight adjustments to the magnitude of the coefficients, but no directionality changes or improvements to statistical significance. The following results will test the more granular, school district level mill levy reduction independent variable on both dependent variables. The only substitution in the following set of regressions will be the variable PropTaxRelief2SchoolDist for PropTaxRelief2County.

5.2. School District Total Levy Reductions on Cost of Education

This section provides a second iteration results of the previous section due to mill levy data being available at both the county and school district level of analysis. These are also the results that are the most important findings of the paper. The following two tables of results are functionally the same in structure are the prior two, but have PropTaxRelief2County replaced with PropTaxRelief2SchoolDist, the total levy value at the school district level. This is anticipated to be more precise, given the granularity of the data. Results for the dependent variable CostPPExp are in the first table and those for CostPPAllEducExp are in the second.

Table 5.3. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2SchoolDist on CostPPExp

Models	(1) OLS	(2) OLS w/ Controls	(3) Fixed Effects	(4) Fixed Effects w/Controls	(5) Two-Way Fixed Effects	(6) Two-Way Fixed Effects w/Controls
PropTaxRelief1AllocationT	-0.0264	0.00616	0.164***	0.0903**	-0.00651	-0.0386
	(0.0687)	(0.0670)	(0.0517)	(0.0399)	(0.0416)	(0.0450)
PropTaxRelief2Dummy	6,382***	-2,453***	2,741***	18.50	7,250***	10,113***
	(784.3)	(942.6)	(1,006)	(1,364)	(1,398)	(2,062)
PropTaxRelief2SchoolDist	-103.1***	35.28*	50.19*	73.58*	55.52*	63.01**
	(22.19)	(20.85)	(29.78)	(36.82)	(28.85)	(30.55)
PropTaxPercentPersonalIncome		-272,526***		36,451		103,331
		(28,744)		(67,397)		(77,333)
K12Enrollment		0.134		-0.0551		-0.0419
		(0.0859)		(0.115)		(0.0974)
PerCapitaIncome		-0.143***		0.109**		0.0236
		(0.0276)		(0.0533)		(0.0367)
TaxValTotalPop		2.118***		0.517*		0.221
		(0.140)		(0.280)		(0.263)
MedianHouseValue		-0.0278***		-0.0214		-0.0477***
		(0.00868)		(0.0166)		(0.0178)
HomeOwnRate		-56.61*		87.77		86.39
		(28.93)		(77.06)		(65.29)
PercentBachDegree		-17.82		-31.34		-116.5
		(44.31)		(62.26)		(72.80)
Constant	14,253***	26,532***	13,913***	1,778	11,293***	4,212
	(360.6)	(2,489)	(201.8)	(7,812)	(376.3)	(6,045)
Observations	742	742	742	742	742	742
R-squared	0.091	0.349	0.207	0.288	0.349	0.403
Number of Counties			53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from this test are significantly more promising than the set of previous models run with the PropTaxRelief2County variable. There is little augmentation in the R-squared values from the previous set with values reaching .4 in the most complete model specification, and no real change in the results from the OLS or one-way fixed-effects models. The one way fixed-effects model maintained positive and statistically significant coefficient estimates for both PropTaxRelief1Allocation and PropTaxRelief2SchoolDist indicating that under this model specification, greater property tax relief increases per pupil expenditures. The improvement in this model from the previous comes in the two-way fixed-effects results. In both, the PropTaxRelief2SchoolDist term is statistically significant at the 10 percent level without controls and at the 5 percent level with them. The coefficient remained positive. These results indicate that, even when time fixed effects are included in the model and other factors of variations are controlled for, a decrease in the mill levy rate (or a greater reduction in mill levies) after property tax relief was enacted in 2013 results in an increase in per pupil expenditures on education, where a one mill decrease in the total school district levy leads to an increase in per pupil expenditures by approximately $63. PropTaxRelief1Allocation showed no improvement with this change in the mill levy relief term and its statistical significance did not improve, indicating that PropTaxRelief1Allocation has no statistically significant effect on per pupil education spending when two-way fixed effects are implemented. This same model is also tested on the second dependent variable, CostPPAllEducExp.

Table 5.4. PropTaxRelief1Allocation, PropTaxRelief2Dummy, and PropTaxRelief2SchoolDist on CostPPAllEducExp

Models	(1) OLS	(2) OLS w/ Controls	(3) Fixed Effects	(4) Fixed Effects w/Controls	(5) Two-Way Fixed Effects	(6) Two-Way Fixed Effects w/Controls
PropTaxRelief1AllocationT	-0.0459	0.0102	0.117***	0.0616***	-0.0123	-0.0361
	(0.0475)	(0.0465)	(0.0344)	(0.0195)	(0.0208)	(0.0250)
PropTaxRelief2Dummy	5,196***	-496.5	2,618***	547.2	6,063***	8,416***
	(542.1)	(653.4)	(671.9)	(926.9)	(1,012)	(1,474)
PropTaxRelief2SchoolDist	-77.11***	16.75	33.43*	49.76*	37.99**	39.83*
	(15.34)	(14.45)	(19.83)	(24.91)	(18.79)	(19.87)
PropTaxPercentPersonalIncome		-192,177***		-2,323		42,949
		(19,925)		(39,700)		(47,485)
K12Enrollment		0.0745		-0.0132		-0.00219
		(0.0595)		(0.0878)		(0.0716)
PerCapitaIncome		-0.102***		0.0533*		-0.00938
		(0.0191)		(0.0280)		(0.0211)
TaxValTotalPop		1.428***		0.410**		0.167
		(0.0973)		(0.190)		(0.173)
MedianHouseValue		-0.0207***		-0.0101		-0.0322***
		(0.00602)		(0.0105)		(0.0111)
HomeOwnRate		-32.29		67.14		66.56
		(20.05)		(50.22)		(40.57)
PercentBachDegree		-42.60		-1.880		-63.73
		(30.71)		(43.96)		(51.61)
Constant	11,037***	20,082***	10,745***	2,719	8,659***	4,688
	(249.2)	(1,726)	(145.2)	(5,008)	(300.2)	(4,020)
Observations	742	742	742	742	742	742
R-squared	0.130	0.373	0.282	0.353	0.436	0.482
Number of Counties			53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from this set of regressions show essentially the same results as the prior iteration, except for an increase in R-squared values across all the models and some declinations in the magnitude of the coefficients for PropTaxRelief2SchoolDist. The coefficients remained positive and statistically significant, so the results reconfirm the confidence received from the implementation of the previous model. In this instance, a 1 mill declination results in an estimated increase in per pupil "cost of education" expenditures of $39. I am not able to derive any conclusive findings regarding the effect that PropTaxRelief1Allocation has on per pupil expenditures, as the incorporation of time fixed effects leads to a loss of statistical significance for this variable. I can, though, be confident that there is evidence to suggest that the greater the declination in school district mill levies, variable PropTaxRelief2SchoolDist, leads to increases in per pupil education expenditures, even when controlling for expected increases in expenditures due to the funding formula and time effects. This at least partially validates my proposed hypothesis, that the property tax relief implemented leads to increases in education expenditures for the property tax relief implemented in 2013.

These results are validated by the findings from the robustness check conducted at the school district level of analysis and presented in the appendix in table A.2. The results presented in that section of the appendix are not aggregated up to the county level, and instead use the school district level of analysis as the unit fixed effect to allow for the observance of greater heterogeneity between local school districts. Even without the addition of controls, as essentially none were available at that level of analysis, the results are consistent with those presented in this section, with the variable PropTaxRelief1Allocation not having statistical significance. The instrument used to model the second round of property tax relief (PropTaxRelief2SchoolDist in section 5.2, PTR2 in the appendix) is also positive and statistically significant. This provides validity and confidence to the model and these findings.

Additional iterations of these models with slight adjustments are run as tests for robustness and can be found in the appendix sections 3 and 4. The first of these in appendix section 3 utilizes a different variable to measure the effect the property tax relief that occurred due to the 2009 legislation, and the model presented in appendix section 4 implements the methodology of logging the variables on both sides of the regression equation to test elasticities. The findings from these robustness checks tend to neither add significance to, nor detract from the results found in sections 5.1 and 5.2.

The variables CostPPAllEducExp and CostPPExp are broken into subcomponents by the North Dakota Department of Public Instruction. Some of these variables are CapOutlaysPPExp (Per Pupil Capita Outlays), AdminPPExp (Per Pupil Administrative Expenditures), and STFALPP (Per Pupil Staff Salaries), and they are constructed as indicated in table 4.2.2. These are tested to identify if the effects of the model are consistent for the subcomponents of the dependent variable. The results from these regressions can be found in section 5 of the appendix. The findings are inconclusive and do not provide much additional information as to the effect of property tax relief on where the increases in expenditures were directed.

CHAPTER 6. SUMMARY, DISCUSSION AND CONCLUSION

6.1. Summary

In this study of the effect of the 2009 and 2013 property tax relief policies on state education expenditures in North Dakota I followed the approach of Zhao and Jung (2008) to examine if the property tax relief that occurred in both packages led to increases in per pupil education expenditures. To do so, I utilized data from the North Dakota Department of Public Instruction, the Office of the North Dakota Tax Commissioner, the U.S. Census Bureau and a few other sources. I ran set of panel fixed-effects and two-way fixed-effects regression models, which allowed me to test the effects of the two policy interventions while controlling for expected increases in education expenditures over the time span.

The results of the models provide support to the hypothesis that property tax relief led to increases in expenditures for at least one of the two pieces of legislation. Greater decreases in school district-imposed property tax mill levies after the second round of property tax relief, that occurred in 2013, have a statistically significant, positive relationship with per pupil expenditures, even when controlling for increases in expenditures and exogenous time effects. This indicates that greater property tax relief induced by the 2013 property tax relief led to increases in educational expenditures, where a one-mill declination in school district mill levy rates led to increases in education expenditures by $39 or $63 dollars, depending on the dependent variable being analyzed. The effect of the first round of property tax relief (PropTaxRelief1Allocation) proves to be inconclusive as these effects do not translate to statistical significance when time fixed effects are incorporated in the primary models. The change in directionality of the coefficient that occurs in the model iterations between the one and two-way fixed effects models also weakens the interpretability the results from this variable, PropTaxRelief1Allocation. These results at least partially validate my hypothesis, that property tax relief and the subsequent intergovernmental transfers that were implemented lead to increases in per pupil education expenditures and that an instance of fiscal illusion occurred in the implementation of the second round of property tax relief.

6.2. Implications

As my findings show, property tax relief that occurred as a result of the implementation of the 2013 integrated funding formula and subsequent property tax relief to local school districts is statistically significantly and positively correlated with increases in per pupil education expenditures. The implications of this are that there is evidence that fiscal illusion occurred in this instance, leading to increased expenditures that were not accounted for as a result of property tax relief.

One consequence of such policies as the 2013 integrated funding formula and property tax relief is that the expenditures on education increased above the anticipated level. This leads to greater overall burdens on taxpayers in the state. Taxpayers must fund an education system that's expenditures are greater than before the programs were implemented, and greater than those programs accounted for, leading to a likely overall higher tax burden. Another consequence of these programs is that increasing reliance on state or centralized revenue as compared to local government revenue to fund local services can results in a loss in the heterogeneity between local municipalities. Tiebout (1956) writes of the importance of the ability for local governments to distinguish themselves from others in terms of what they provide to constituents. He proposes that local governments compete against one another in their provision of various public services. Some governments may tax to a greater or lesser extent and may differ in the set and quality of public services that they provide. Individuals can reveal their preferences for tax and expenditure bundles as they choose where to reside from the options available. This can result in a more efficient market with greater choice in the 'marketplace' of public services. Decreasing reliance on local control of taxation and public expenditure reduces the ability for local governments to differentiate themselves, limiting the set of choices available for individuals, and arguably occurred with the implementation of the 2009 and 2013 legislation. Arguably, this means that the programs reduced property taxes and attempted to increased education equity at the expense of reduced local autonomy.

6.3. Extensions to Research

Possible extensions to this research are fruitful. There is a distinct area of the public and educational finance literature associated with the analysis of the efficiency of the use of public resources. A subsection of this attempts to analyze the efficiency of education to determine if educational resources are being used conservatively, and if increases in resources lead to improvements in performance at an efficient rate. Since per pupil expenditures have risen in the state, due in part to both the 2009 and 2013 legislation, an analysis as to whether these increases in resources led to efficient increases in student performance may be an interesting, useful, and timely study. Other extensions could be conducted to analyze the effect of this property tax relief or the increase in public education expenditures on the other forms of taxation and expenditures in the state (i.e. whether the increase in expenditures was actually offset by oil revenues or if other property taxes were imposed due to the reduction in school district taxes, etc.). This could provide insight into the broader effects of these policies on the broader fiscal status and health of the state. I hope this thesis inspires greater exploration into the effects of policy on the fiscal status health of the state of North Dakota.

REFERENCES

Addonizio, M. F. (1991). Intergovernmental grants and the demand for local educational expenditures. Public Finance Quarterly, 19(2), 209–232. https://doi.org/10.1177/109114219101900205

Arnott, R. (2004). Does the Henry George Theorem Provide a Practical Guide to Optimal City Size? *American Journal of Economics and Sociology*, *63*(5), 1057–1090. https://doi.org/10.1111/j.1536-7150.2004.00334.x

Baker, S. H. (1983). The Determinants of Median Voter Tax Liability: an Empirical Test of the Fiscal Illusion Hypothesis. Public Finance Quarterly, 11(1), 95–108. https://doi.org/10.1177/109114218301100106

Breeden, C., & Hunter, W. (1985). Tax Revenue and Tax Structure. Public Finance Quarterly, 13(2), 216–224.

Brien, S. T., & Sjoquist, D. L. (2014). Do State-funded Property Tax Exemptions Actually Provide Tax Relief? Georgia's HTRG Program. Public Finance Review, 42(5), 608–634. https://doi.org/10.1177/1091142114527783

Bolli, T., Olivares, M., Bonaccorsi, A., Daraio, C., Aracil, A. G., & Lepori, B. (2016). The differential effects of competitive funding on the production frontier and the efficiency of universities. *Economics of Education Review*, *52*, 91–104. https://doi.org/10.1016/j.econedurev.2016.01.007

Buchanan, J. M., & Wagner, R. E. (1977). *Democracy in Deficit*. New York: Acad. Pr.

Cabral, M., & Hoxby, C. (2012). The hated property tax: Salience, tax rates, and tax revolts. https://doi.org/10.3386/w18514

Card, D., & Payne, A. A. (2002). School finance reform, the distribution of school spending, and the distribution of student test scores. *Journal of Public Economics*, *83*(1), 49–82. https://doi.org/10.1016/s0047-2727(00)00177-8

Cenedella, D., & Melnik, S. (2009, December 1). *An overview of major property tax relief measures*. The Tax Adviser. https://www.thetaxadviser.com/issues/2009/dec/anoverviewofmajorpropertytaxreliefmeasures.html.

Congressional Research Service. (2019, August 26). *State and Local Financing of Public Schools*. EveryCRSReport.com. https://www.everycrsreport.com/reports/R45827.html.

Congressional Research Service. (2019, August 26). State and Local Financing of Public Schools. EveryCRSReport.com. https://www.everycrsreport.com/reports/R45827.html#:~:text=%25%20to%2012.7%25.-,The%20primary%20source%20of%20local%20revenues%20for%20public%20elementary%20and,products%20and%20alcoholic%20beverages%2C%20and.

Craig, S. G., & Inman, R. P. (1982). Federal aid and public Education: An empirical look at the new Fiscal Federalism. The Review of Economics and Statistics, 64(4), 541. https://doi.org/10.2307/1923938

da Cruz, N. F., & Marques, R. C. (2014). Revisiting the Determinants of Local Government Performance. *Omega*, *44*, 91–103. https://doi.org/10.1016/j.omega.2013.09.002

Deller, Steven & Maher, Craig & Lledo, Victor, 2002. "Wisconsin Local Government, State Shared Revenues and the Illusive Flypaper Effect," Staff Paper Series 451, University of Wisconsin, Agricultural and Applied Economics.

Dollery, B., & Worthington, A. (1995). Federal Expenditure and Fiscal Illusion: A Test of the Flypaper Hypothesis in Australia. Publius, 25(1), 23–34.

Dollery, B. E., & Worthington, A. C. (1996). THE EMPIRICAL ANALYSIS OF FISCAL ILLUSION. Journal of Economic Surveys, 10(3), 261–297. https://doi.org/10.1111/j.1467-6419.1996.tb00014.x

Drukker, D. M. (2003). Testing for serial correlation in Linear Panel-data models. *The Stata Journal: Promoting Communications on Statistics and Stata, 3*(2), 168–177. https://doi.org/10.1177/1536867x0300300206

Elementary and Secondary Education Expenditures. Urban Institute. (2020, June 9). https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/elementary-and-secondary-education-expenditures#Question1K12.

Eom, T., & Rubenstein, R. (2006). Do State-Funded Property Tax Exemptions Increase Local Government Inefficiency? An Analysis of New York State's STAR Program. Public Budgeting Finance, 26(1), 66–87. https://doi.org/10.1111/j.1540-5850.2006.00839.x

Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society*, *120*(3), 253. https://doi.org/10.2307/2343100

Filimon, R., Romer, T., & Rosenthal, H. (1982). Asymmetric Information and Agenda Control. Journal of Public Economics, 17(1), 51–70. https://doi.org/10.1016/0047-2727(82)90025-1

Fishel, William. A. (2005). The Homevoter Hypothesis. Harvard University Press. https://doi.org/10.2307/j.ctv1p6hp64

Folger, J. (2021, March 04). Real Property. Retrieved March 27, 2021, from https://www.investopedia.com/terms/r/real-property.asp

Fong, C. (2009, July). *July 2009 Schedule of Levy Limitations; Applicable to the Authority of the Political Subdivisions of the State of North Dakota to Levy Ad Valorem Taxes on Property*. https://www.nd.gov/tax/.

Fox, J. (2017, November 28). *Why Economists Love Property Taxes and You Don't*. Bloomberg.com. https://www.bloomberg.com/opinion/articles/2017-11-28/why-economists-love-property-taxes-and-you-don-t.

Grand Forks Herald. (2009, January 22). *N.D. legislators tackle property tax relief*. Grand Forks Herald. https://www.grandforksherald.com/news/2089203-nd-legislators-tackle-property-tax-relief.

Grossman, P. J. (1990). The Impact of Federal and State Grants on Local Government Spending: a Test of the Fiscal Illusion Hypothesis. Public Finance Quarterly, 18(3), 313–327. https://doi.org/10.1177/109114219001800304

Grubb, W. N., & Osman, J. W. (1977). The causes of school Finance INEQUALITIES: Serrano and the case of California. Public Finance Quarterly, 5(3), 373–392. https://doi.org/10.1177/109114217700500305

Hartman, W., & Hwang, C. S. (1985). Effectiveness of Property Tax Relief in Oregon. *Journal of Education Finance*, *10*(3), 339–359.

Hausman, J. A., & Taylor, W. E. (1981). Panel Data and Unobservable Individual Effects. *Journal of Econometrics*, *16*(1), 155. https://doi.org/10.1016/0304-4076(81)90085-3

Hines, J. R., & Thaler, R. H. (1995). Anomalies: The Flypaper effect. Journal of Economic Perspectives, 9(4), 217–226. https://doi.org/10.1257/jep.9.4.217

IDRA. *Equity and Adequacy Concepts as Considered in School Finance Court Cases*. (2018, April 5). https://www.idra.org/resource-center/equity-and-adequacy-concepts-as-considered-in-school-finance-court-cases/

Imai, K., & Kim, I. S. (2020). On the use of two-way fixed effects regression models for causal inference with panel data. *Political Analysis*, *29*(3), 405–415. https://doi.org/10.1017/pan.2020.33

Inman, R. (2008). The flypaper effect. NBER, Working Paper 14579. https://doi.org/10.3386/w14579

Jackson, C. K., Johnson, R., & Persico, C. (2014). The Effect of School Finance Reforms on the Distribution of Spending, Academic Achievement, and Adult Outcomes. https://doi.org/10.3386/w20118

Johnes, J. (2013). Efficiency and Mergers in English Higher Education 1996/97 to 2008/9: Parametric and Non-parametric Estimation of the Multi-input Multi-output Distance Function. The Manchester School, 82(4), 465–487. https://doi.org/10.1111/manc.12030

Jordan, M., Chapman, D., & Wrobel, S. (2014). RICH DISTRICTS, POOR DISTRICTS: THE PROPERTY TAX EQUITY IMPACT OF ARKANSAS SCHOOL FINANCE EQUALIZATION. *Public Finance and Management*, *14*(4), 399–415.

Jung, C. (2001). Does the Local-Option Sales Tax Provide Property Tax Relief? The Georgia Case. *Public Budgeting & Finance*, *21*(1), 73–86. https://doi.org/10.1111/0275-1100.00037

Kagan, J. (2021, May 19). *What is a Property Tax?* Investopedia. https://www.investopedia.com/terms/p/propertytax.asp.

Kenyon, D. (2007). *The Property Tax School Funding Dilemma*. Lincoln Institute of Land Policy. https://www.lincolninst.edu/sites/default/files/pubfiles/the-property-tax-school-funding-dilemma-full_0.pdf.

Kiesling, H. J. (1967). Measuring a Local Government Service: A Study of School Districts in New York State. *The Review of Economics and Statistics, 49*(3), 356. doi:10.2307/1926645

Levin, H. M. (1974). Measuring Efficiency in Educational Production. Public Finance Quarterly, 2(1), 3–24. https://doi.org/10.1177/109114217400200101

Lemieux, P., Sumner, S., & Henderson, D. (2018, August 21). *Land taxes: The return of Henry George*. Econlib. https://www.econlib.org/land-taxes-the-return-of-henry-george/.

Lincoln Institute. (2018). North Dakota. Retrieved March 19, 2021, from https://www.lincolninst.edu/sites/default/files/nd_feb_2018.pdf

Logan, R. R. (1986). Fiscal Illusion and the Grantor Government. *Journal of Political Economy*, *94*(6), 1304–1318. https://doi.org/10.1086/261434

Lutz, B. (2010). Taxation with Representation: Intergovernmental Grants in a Plebiscite Democracy. *Review of Economics and Statistics*, *92*(2), 316–332. https://doi.org/10.1162/rest.2010.12258

McCulloch, J. R. (1852). *A Treatise on the Principles and practical Influence of Taxation and the Funding System*. London.

Megdal, S. B. (1983). Equalization of expenditures and the demand for local public education: The case of New Jersey. Public Finance Quarterly, 11(3), 365–376. https://doi.org/10.1177/109114218301100306

Megdal, S. B. (1987). The Flypaper Effect Revisited: An Econometric Explanation. The Review of Economics and Statistics, 69(2), 347. https://doi.org/10.2307/1927243

Mill, J. S. (1848). *Principals of Political Economy*. John W. Parker.

Misiolek, W. S., & Elder, H. W. (1988). Tax structure and the size of government: An empirical analysis of the fiscal illusion and fiscal stress arguments. Public Choice, 57(3), 233–245. https://doi.org/10.1007/bf00124807

Murray, S., Evans, W., & Schwab, R. (1998). Education-Finance Reform and the Distribution of Education Resources. *The American Economic Review*, *88*(4), 789–812.

National Center for Education Statistics. (2017, October). *Digest of Education Statistics, 2017*. National Center for Education Statistics (NCES) Home Page, a part of the U.S. Department of Education. https://nces.ed.gov/programs/digest/d17/tables/dt17_235.10.asp.

North Dakota Department of Public Instruction – School Finance . (2014). *North Dakota K-12 School Funding Formula*. https://www.nd.gov/dpi/sites/www/files/documents/SFO/StateAidFormulav2.pdf.

North Dakota Legislative Branch. (2009a). Sixty-first Legislative Assembly of North Dakota In Regular Session Commencing Tuesday, January 6, 2009. Retrieved April 29, 2021, from https://www.legis.nd.gov/assembly/61-2009/bill-text/JQNQ0600.pdf

North Dakota Legislative Branch. (2009b). North Dakota Legislative Branch. Measure Actions. https://www.legis.nd.gov/assembly/61-2009/bill-actions/ba2199.html.

North Dakota Legislative Branch. (2015). *North Dakota Legislative Branch*. North Dakota Bill Versions: HB 1377. https://www.legis.nd.gov/assembly/64-2015/bill-index/bi1377.html.

North Dakota Legislative Branch. North Dakota Bill Actions: HB 1013. (n.d.). https://www.legis.nd.gov/assembly/67-2021/bill-actions/ba1013.html.

North Dakota Legislative Council. (2009, October). Property tax reform and relief - background memorandum. Retrieved September 9, 2021, from http://www.legis.nd.gov/files/resource/committee-memorandum/13.9044.01000.pdf.

North Dakota Legislative Council. (2019). *ELEMENTARY AND SECONDARY EDUCATION STATE AID AND FUNDING* ... https://www.legis.nd.gov/files/resource/committee-memorandum/21.9021.01000.pdf.

North Dakota Office of the State Tax Commissioner. (n.d.). Retrieved March 27, 2021, from https://www.nd.gov/tax/user/individuals/forms--publications/property-tax

Oates, W. E. (1972). Fiscal federalism. Harcout Brace Jovanovich.

Oates, W. E. (1985). On the nature and measurement of fiscal illusion: A survey. In *On the nature and measurement of fiscal illusion: A survey* (pp. 65-82). College Park, MD: Dept. of Economics, University of Maryland. doi:http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.409.4839&rep=rep1&type=pdf

Odden, A., Picus, L., Goetz, M., Aportela, A., & Archibald, S. (2008, July 31). *Funding Schools Adequately in North Dakota: Resources to Double Student Performance*. http://picusodden.com/wp-content/uploads/2013/09/ND_Adequacy_Report_Final_for_September.pdf.

Office of the North Dakota Tax Commissioner. (2012). 2012 State and Local Taxes - An Overview and Comparative Guide (Red Book). Retrieved April 29, 2021, from https://www.nd.gov/tax/data/upfiles/media/2012-redbook.pdf

Ostrom, V., & Ostrom, E. (1971). Public choice: A different approach to the study of public administration. *Public Administration Review, 31*(2), 203. doi:10.2307/974676

Paul Courant, Edward Gramlich, and Daniel Rubinfeld, "The Stimulative Effects of Intergovernmental Grants: Or Why Money Sticks Where It Hits," Fiscal Federalism and Grants-in-Aid, eds. Peter Mieszkowski and William Oakland (Washington, D.C.: The Urban Institute, 1979), pp. 5-21.

Perelman, S., & Santin, D. (2011). Measuring educational efficiency at student level with parametric stochastic distance functions: an application to Spanish PISA results. Education Economics, 19(1), 29–49. https://doi.org/10.1080/09645290802470475

Plummer, E. (2006). The effects of state funding on property tax rates and school construction. *Economics of Education Review*, *25*(5), 532–542. https://doi.org/10.1016/j.econedurev.2005.04.002

Public Finance in Democratic Process. (1967). In *Public Finance in Democratic Process* (pp. 125-142). S.l.: The University of North Carolina Press Chapel Hill.

Rauschenberger, R. (2011). Valuation concepts - Residential and Commercial Property. Retrieved March 27, 2021, from http://www.nd.gov/tax/data/upfiles/media/conceptsresidentialcommercialproperty.pdf

Rauschenberger, R. (2014). Valuation Concepts - Agricultural Property Guideline. Retrieved March 27, 2021, from https://www.nd.gov/tax/data/upfiles/media/valuationconceptsagriculturalproperty.pdf

Rauschenberger, R. (2015, July). *Jul 2015 Schedule of Levy Limitations; Applicable to the Authority of the Political Subdivisions of the State of North Dakota to Levy Ad Valorem Taxes on Property*. ND Tax. https://www.nd.gov/tax/.

Raushenberger, R. (2020, December). *2020 State and Local Taxes An Overview and Comparative Guide*. ND Tax. https://www.nd.gov/tax/data/upfiles/media/red-book-2020-online-version.pdf.

Rosengard, J. K. (2012). The tax everyone loves to hate. *A Primer on Property Tax*, 173–186. https://doi.org/10.1002/9781118454343.ch7

Roy, J. (2003). Impact of school finance reform on Resource Equalization and academic performance: Evidence from Michigan. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.630121

Sausgruber, R., & Tyran, J.-R. (2005). Testing the mill hypothesis of fiscal illusion. Public Choice, 122(1-2), 39–68. https://doi.org/10.1007/s11127-005-3992-4

Schneider, M. (1986). Fragmentation and the Growth of Local Government. Public Choice, 48(3), 255–263. https://doi.org/10.1007/bf00051622

Seabury, C. (2021, May 19). *How property taxes are calculated*. Investopedia. https://www.investopedia.com/articles/tax/09/calculate-property-tax.asp.

Sfeir, R. E. (1986). Production Frontier Estimates of Scale in Public Schools in California. Economics of Education Review, 5(3), 297–307. https://doi.org/10.1016/0272-7757(86)90081-6

Shaw, J. S. (n.d.). Public choice theory. Retrieved February 18, 2021, from https://www.econtalk.org/library/Enc1/PublicChoiceTheory.html

Sherman, F. (2019, March 11). *What is the difference between assessed value & taxable value of real estate?* Finance. https://finance.zacks.com/difference-between-assessed-value-taxable-value-real-estate-8455.html.

Sjoquist, D. (1982). THE EFFECT OF THE NUMBER OF LOCAL GOVERNMENTS ON CENTRAL CITY EXPENDITURES. National Tax Journal, 35(1), 79–87. https://doi.org/10.1086/ntj41862421

Skinner, R. R. (2019, August 26). *State and local financing of public schools*. Congressional Research Service. https://crsreports.congress.gov/product/pdf/R/R45827.

Smith, N. (2013, May 5). *North Dakota Lawmakers Provide Record Education Funding*. Bismarck Tribune. https://bismarcktribune.com/news/local/govt-and-politics/north-dakota-lawmakers-provide-record-education-funding/article_f42e8084-b53e-11e2-b4c1-0019bb2963f4.html.

Stark, J. O., A history of the property tax and property tax relief in Wisconsin (1992). Madison, WI; The Bureau.

Stevens, P. A. (2005). A Stochastic Frontier Analysis of English and Welsh Universities. Education Economics, 13(4), 355–374. https://doi.org/10.1080/09645290500251581

Tax Foundation. (n.d.). *What is a property tax?* Tax Foundation. https://taxfoundation.org/tax-basics/property-tax/.

Tescher, A. (2018). *Property Tax – Funding Formula*. North Dakota Legislative Branch. https://www.legis.nd.gov/files/committees/65-2017/19_5145_03000appendixk.pdf.

Turnbull, G. K. (1998). The overspending and flypaper effects of fiscal illusion: Theory and empirical evidence. Journal of Urban Economics, 44(1), 1–26. https://doi.org/10.1006/juec.1997.2056

Tyer, C. B. (1993). The Property Tax: Why It Persists. *The South Carolina Policy Forum Magazine*, *2*(4).

Urban Institute. (2021, May 25). *Property Taxes*. https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/projects/state-and-local-backgrounders/property-taxes.

Varela, P. (2016, March). *What is Tax Salience?* https://taxpolicy.crawford.anu.edu.au/sites/default/files/publication/taxstudies_crawford_anu_edu_au/2018-05/varela_salience_mar_2016_complete_0.pdf.

Wagner, R. E. (1976). Revenue Structure, Fiscal Illusion, and Budgetary Choice. Public Choice, 25(1), 45–61. https://doi.org/10.1007/bf01726330

Wallace E. Oates, "Lump-Sum Intergovernmental Grants Have Price Effects," Fiscal Federalism and Grants-in-Aid, pp. 23-30.

Wenglinsky, H. (1998). Finance equalization and within-school equity: The relationship between education spending and the social distribution of achievement. Educational Evaluation and Policy Analysis, 20(4), 269–283. https://doi.org/10.3102/01623737020004269

West, E. G., & Winer, S. L. (1980). Optimal Fiscal Illusion and the Size of Government. Public Choice, 35(5), 607-622. doi:10.1007/bf00140089

Winer, S. L. (1983). Some Evidence on the Effect of the Separation of Spending and Taxing Decisions. *Journal of Political Economy*, *91*(1), 126–140. https://doi.org/10.1086/261131

Wyckoff, P. G. (1991). The elusive flypaper effect. Journal of Urban Economics, 30(3), 310–328. https://doi.org/10.1016/0094-1190(91)90052-9

Youngman, J. (2016, April). School finance and property taxes. Retrieved September 13, 2021, from https://www.lincolninst.edu/publications/articles/school-finance-property-taxes.

Zhao, Z., & Jung, C. (2008). Does Earmarked Revenue Provide Property Tax Relief? Long-Term Budgetary Effects of Georgia's Local Option Sales Tax*. *Public Budgeting & Finance*, *28*(4), 52–70. https://doi.org/10.1111/j.1540-5850.2008.00916.x

APPENDIX A. SUMMARY OF MAJOR RELEVANT POLICY CHANGES

Table A.1. Summary of Major Relevant Policy Changes

Year Enacted	Policy Change
2007	New funding formula was implemented with slight adjustments to the funding structure. An additional nearly $100 million was allocated by the state government to education.
2009	Increase in funding continued to add another $100 million in annual funding to K-12 education. Implemented $300 million of property tax relief to local school districts from state government that led to lower local mill levies for school districts.
2011	Continued policy of property tax relief and increases in state allocations to fund education.
2013	Implementation of integrated funding formula that increased expenditures on education by somewhere around $500 million over the biennium (or just under $250 million per year) and implemented an additional round of property tax relief, leading to even lower mill levies.

APPENDIX B. MODEL ITERATION RUN AT SCHOOL DISTRICT LEVEL

Table B.1. Model Iteration Run at School District Level

VARIABLES	(1) CCPCOEALLEXP, Fixed-Effects	(2) CCPCOEALLEXP, Two-Way Fixed-Effects	(3) CostPPExp, Fixed-Effects	(4) CostPPExp, Two-Way Fixed-Effect
PropTaxRelief1Allocation	0.000333***	-1.72e-05	0.000262***	4.88e-06
	(7.98e-05)	(6.74e-05)	(6.42e-05)	(4.60e-05)
PropTaxRelief2Dummy	1,085	5,645***	1,479	4,821***
	(1,328)	(1,916)	(1,060)	(1,482)
PTR2	54.64**	48.73**	37.77**	34.96*
	(22.01)	(23.40)	(17.43)	(18.28)
K12Enrollment	-0.795	-1.699**	-0.671	-1.384**
	(0.563)	(0.723)	(0.488)	(0.619)
Constant	13,368***	11,335***	10,358***	8,860***
	(301.2)	(449.6)	(259.9)	(378.6)
Observations	2,380	2,380	2,380	2,380
R-squared	0.181	0.274	0.257	0.364
Number of SchoolDist	170	170	170	170

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from table B.1 above are one and two-way fixed-effects regression models at the school district level of analysis. The variables presented of the same construction as those presented in section 5.2, though not averaged and summed to be at the county level. School districts less consistent over time than counties; some are formed, and some are dissolved in the matter of a few years. Due to this, only school districts that were listed in 2018 and were in existence over the entire timespan are included. No controls besides K-12 enrollment are included as the others are only available at the county level. The findings from these results, particularly for the model with two-way fixed effects, are consistent with those presented in section 5.2 as well, where PTR2 is positive and statistically significant for both dependent variables. PTR2 is the variable that represents the declination in mill rates after the implementation of the 2013 legislation, which was represented by PropTaxRelief2SchoolDist and PropTaxRelief2County in the previous model iterations. Specifically, for CCPCOEALLEXP with two-way fixed-effects, PTR2 is positive where a one-unit declination in mill rates in a school district, per-pupil cost of education expenditures increases by ~$49. For CostPPExp, PTR2 is positive, and a one-unit mill levy declination leads to a ~$35 increase in per-pupil overall education expenditures. R-squared values for the two-way fixed-effects models are .27 and .36 for CCPCOEALLEXP and CostPPExp respectively. With a relatively strong model fit, especially without a full set of controls, and consistency with the findings of the results presented in section 5.2, this regression improves my confidence with the results presented at the county level of analysis.

APPENDIX C. ROBUSTNESS CHECK USING PROPTAXRELIEF1MILLREDUCTION

Another separate variable was constructed in the same manner as the PropTaxRelief2County and PropTaxRelief2SchoolDist variables to model the effect of the first round of property tax relief. I tested the same models as I ran in section 5.2 using this variable, PropTaxRelief1MillReduction in the place of PropTaxRelief1Allocation. Only one base model specification is presented as it was found in the iterations run in section 5.2 that instrumenting PropTaxRelief2County provided the best results for the model. Logically PropTaxRelief1MillReduction should be used in tandem to provide the most consistent results. These models are used as a robustness check and not the primary results presented as the variable PropTaxRelief1MillReduction. This is because PropTaxRelief1MillReduction, even though an appropriate instrument, has collinearity concerns with PropTaxRelief2SchoolDist as they are constructed in the same manner. The output from these regressions on the dependent variables CostPPAllEducExp and CostPPExp are presented below. Only one and two way fixed-effects models with controls are included for simplicity.

Table C.1. PropTaxRelief1MillReduction, PropTaxRelief2Dummy, & PropTaxRelief2SchoolDist on CostPPAllEducExp and CostPPExp

MODELS	(1) CostPPAllEducExp, Fixed-Effects	(2) CostPPAllEducExp Two-Way Fixed-Effects	(3) CostPPExp, Fixed-Effects	(4) CostPPExp, Two-Way Fixed-Effects
PropTaxRelief1MillReduction	28.06***	-37.01	33.46***	-71.86*
	(3.800)	(22.44)	(5.774)	(35.87)
PropTaxRelief2Dummy	2,424***	8,325***	2,248*	9,856***
	(841.0)	(1,534)	(1,296)	(2,155)
PropTaxRelief2SchoolDist	43.53*	28.67	64.34*	43.80
	(22.57)	(18.58)	(34.06)	(26.86)
PropTaxPercentPersonalIncome	16,960	10,619	54,671	53,937
	(36,959)	(38,336)	(58,060)	(58,072)
K12Enrollment	-0.157	-0.107*	-0.214	-0.163*
	(0.101)	(0.0631)	(0.140)	(0.0969)
PerCapitaIncome	0.0291	-0.0273	0.0764	-0.00694
	(0.0271)	(0.0223)	(0.0522)	(0.0343)
TaxValTotalPop	0.279	0.183	0.373	0.278
	(0.191)	(0.171)	(0.286)	(0.257)
MedianHouseValue	-0.0102	-0.0274***	-0.0216	-0.0406**
	(0.00959)	(0.0101)	(0.0155)	(0.0158)
HomeOwnRate	82.21*	70.06**	111.6	91.56*
	(47.13)	(33.77)	(70.90)	(49.35)
PercentBachDegree	-17.49	-60.17	-50.77	-113.5
	(44.14)	(49.68)	(58.78)	(71.29)
Constant	2,246	6,106*	1,055	6,409
	(4,959)	(3,445)	(7,631)	(4,745)
Observations	742	742	742	742
R-squared	0.392	0.501	0.319	0.431
Number of Counties	53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from these iterations provide mixed findings. The regression results are similar to those presented in section 5.2 in that the one-way fixed-effects model, with both PropTaxRelief1MillReduction and PropTaxRelief2SchoolDist being positive and statistically significant at the 10% level of confidence or better. These are the expected and hypothesized findings. The results from the two-way fixed-effects models in this table 5.3.1 diverge from results in tables 5.2.1 and 5.2.2, though. PropTaxRelief2SchoolDist loses all degrees of statistical significance, and PropTaxRelief1MillReduction becomes negative and attains statistical significance at the 10 percent level for the model with the dependent variable CostPPExp, though not for CostPPAllEducExp, indicating relatively weak findings that are difficult to derive any strong conclusions from. This divergence from the results presented in section 5.2 wasn't necessarily expected, given the variable is designed to be similar its ability to instrument for the property tax relief that occurred from the first round of relief. Its development and use do have concerns, though, as this variable is developed in the same manner as PropTaxRelief2SchoolDist. By including both variables that are representations of the degree of mill levy relief, collinearity problems may be induced. Given the collinearity concerns with the variable and the subsequent mixed results from this test, this robustness check does not detract from, nor add confidence to the results seen in tables 5.2.1 or 5.2.2.

APPENDIX D. ANALYSIS OF ELASTICITIES FROM PRIMARY MODEL

The results presented in sections 5.1 and 5.2 use variables that are all structured in nominal form. Interpretations are such where we expect increases or decreased in unit form, rather than in percentage form. Given that these nominal values don't tell the entirety of the story as to how the variables are all related, I am also interested in identifying how a one percentage increase in the variables increase or decrease affects the dependent variable in the same respect. This considered an analysis of elasticities and provides greater insight into marginal effects of the independent on the dependent variables. This form also is known commonly as the log-log model specification. To conduct this analysis, variables on both the right- and left-hand side of the regression equation are logged (besides PropTaxRelief2Dummy, given its status as a dummy and the affect that taking the logarithm of a variable that only has ones and zeros would have). Variables that are already in percentage form (which is most of the control variables) are not logged as this would create an improper specification given their status as being in non-nominal form. The base models used are the one-and two way fixed-effects models with and without controls that are presented in tables 5.2.1 and 5.2.2, with the only adjustment being the implementation of the log-log specification. Only the specification from section 5.2 is used, as these models provided the most promising results. The first letter L on each variable signifies that the variable is logged. The results are presented below in two separate tables with the first using the coefficient LCostPPAllEducExp and the second using the coefficient LCostPPExp.

Table D.1. Elasticity Analysis: LPropTaxRelief1Allocation, LPropTaxRelief2SchoolDist on LCostPPAllEducExp

Models	(1) LCostPPAllEducExp Fixed-Effects, No Controls	(2) LCostPPAllEducExp Fixed-Effects, Controls	(3) LCostPPAllEducExp Two-Way Fixed Effects, No Controls	(4) LCostPPAllEducExp Two-Way Fixed-Effects, Controls
LPropTaxRelief1AllocationT	0.0308***	0.0232***	-0.0174***	-0.0169***
	(0.00223)	(0.00241)	(0.00548)	(0.00579)
PropTaxRelief2Dummy	0.262***	0.126	0.474***	0.570***
	(0.0772)	(0.0937)	(0.0703)	(0.110)
LPropTaxRelief2SchoolDist	0.0448*	0.0521**	0.0380*	0.0328
	(0.0226)	(0.0257)	(0.0192)	(0.0230)
PropTaxPercentPersonalIncome		3.532		2.866
		(2.722)		(3.118)
LK12Enrollment		-0.303***		-0.208***
		(0.0528)		(0.0416)
PerCapitaIncome		5.08e-06**		4.40e-07
		(1.91e-06)		(1.55e-06)
TaxValTotalPop		8.25e-06		2.69e-06
		(1.24e-05)		(1.21e-05)
MedianHouseValue		2.29e-07		-1.15e-06
		(7.10e-07)		(6.98e-07)
HomeOwnRate		0.00124		0.000586
		(0.00200)		(0.00187)
PercentBachDegree		-0.000923		-0.00397
		(0.00272)		(0.00265)
Constant	9.124***	10.76***	9.017***	10.40***
	(0.0148)	(0.397)	(0.0208)	(0.361)
Observations	742	742	742	742
R-squared	0.526	0.599	0.634	0.681
Number of Counties	53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D.2. Elasticity Analysis: LPropTaxRelief1Allocation, LPropTaxRelief2SchoolDist on LCostPPExp

VARIABLES	(1) LCostPPExp Fixed-Effects, No Controls	(2) LCostPPExp Fixed-Effects, Controls	(3) LCostPPExp Two-Way Fixed Effects, No Controls	(4) LCostPPExp Two-Way Fixed-Effects, Controls
LPropTaxRelief1AllocationT	0.0313***	0.0238***	-0.0187**	-0.0176**
	(0.00232)	(0.00256)	(0.00710)	(0.00708)
PropTaxRelief2Dummy	0.238***	0.0909	0.447***	0.511***
	(0.0878)	(0.103)	(0.0783)	(0.121)
LPropTaxRelief2SchoolDist	0.0471*	0.0572**	0.0397*	0.0395
	(0.0252)	(0.0283)	(0.0218)	(0.0253)
PropTaxPercentPersonalIncome		5.765*		5.509
		(2.998)		(3.463)
LK12Enrollment		-0.302***		-0.212***
		(0.0570)		(0.0469)
PerCapitaIncome		7.00e-06***		2.37e-06
		(2.31e-06)		(1.95e-06)
TaxValTotalPop		8.44e-06		4.06e-06
		(1.32e-05)		(1.29e-05)
MedianHouseValue		-2.14e-07		-1.47e-06*
		(7.88e-07)		(7.85e-07)
HomeOwnRate		0.00107		0.000349
		(0.00220)		(0.00212)
PercentBachDegree		-0.00138		-0.00444
		(0.00297)		(0.00299)
Constant	9.368***	10.89***	9.266***	10.55***
	(0.0162)	(0.434)	(0.0225)	(0.407)
Observations	742	742	742	742
R-squared	0.473	0.556	0.578	0.632
Number of Counties	53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are to be interpreted where a 1 percent increase in the independent variable results in an X percent increase in the dependent variable, where X is the coefficient. The results show findings largely consistent with those presented in the table 5.3.1, with positive coefficients and statistical significance for LPropTaxRelief1Allocation and LPropTaxRelief2SchoolDist for the one-way fixed-effects regressions and a loss of significance for LPropTaxRelief2SchoolDist and a reversion of the directionality of coefficients for LPropTaxRelief1Allocation for the two-way fixed effects model. LPropTaxRelief2SchoolDist maintains significance when there are no controls. The results between the two sets of regressions with the distinct dependent variables are nearly the same, so I interpret the results from the two models with the dependent variable

CostPPExp. For the model with the one-way fixed effects, a one percent increase in the total aid allocation through PropTaxRelief1Allocation results in an increase in per pupil expenditures by 2.3 percent. A one percent increase in the mill levy reduction from PTR2 (variable PropTaxRelief2SchoolDist) results in a 5.7 percent increase in per pupil expenditures. These results are as expected with respect to those presented in tables 5.2.1 and 5.2.2. For the two-way fixed effects models, the coefficient presented indicate a 1.8 percent declination and 4 percent increase in per pupil expenditures for a one percent increase in the variables PropTaxRelief1Allocation and PropTaxRelief2SchoolDist, respectively. These findings are distinct from those found in the previous iterations of the model, with an increase in significance of the PropTaxRelief1Allocation term for the two-way fixed effects models and a loss of some degree (though not without controls) of significance of the PropTaxRelief2SchoolDist term. This may be due in part to the unique structure of the variables PropTaxRelief2Dummy and PropTaxRelief2SchoolDist and effect that being logged and run with two-way fixed-effects model how they can be interpreted. The statistical significance and negative direction of the coefficients for the PropTaxRelief1Allocation variable provides some concern. The general consistency of the positive and statistically significant coefficient on the PropTaxRelief2SchoolDist in some of the regressions presented in this section, and throughout all the models run throughout the study, I maintain confidence in the general results found that indicate that at least the second round of property tax relief led to increases in education expenditures.

APPENDIX E. TESTING SUBCOMPONENT PER-PUPIL EXPENDITURES VARIABLES

The base one-way and two-way fixed effects models, first with PropTaxRelief2County and then with PropTaxRelief2SchoolDist, are run with all controls on the dependent variables, CapOutlaysPPExp (Per Pupil Capita Outlays), AdminPPExp (Per Pupil Administrative Expenditures), and StaffPPExp (Per Pupil Staff Salaries). These variables represent the prescribed subcomponents of the other dependent variables CostPPExp and CostPPAllEducExp. The subsequent results test whether the property tax relief led to increases in any component that makes up the total expenditure variables.

Table E.1. PropTaxRelief1Allocation, PropTaxRelief2Dummy, & PropTaxRelief2County on CAPEXPPP, ADMEXPPP, and STFALPP

MODELS	(1) CapOutlaysPPExp Fixed Effects	(2) CapOutlaysPPExp Two-Way Fixed Effects	(3) AdminPPExp Fixed Effects	(4) AdminPPExp Two-Way Fixed Effect	(5) StaffPPExp Fixed Effects	(6) StaffPPExp Two-Way Fixed Effects
PropTaxRelief1Allocation	2.29e-06	-6.21e-07	1.01e-05**	-1.71e-06	4.08e-05***	-4.06e-06
	(2.09e-06)	(2.79e-06)	(3.83e-06)	(3.25e-06)	(1.47e-05)	(6.53e-06)
PropTaxRelief2Dummy	-35.55	-224.8*	292.2***	1,461***	1,020***	4,970***
	(56.08)	(125.2)	(86.48)	(194.6)	(252.7)	(633.5)
PropTaxRelief2County	0.878	-0.0677	-2.436	0.238	-9.543	-1.247
	(0.866)	(0.915)	(1.506)	(1.140)	(6.363)	(4.260)
PropTaxPercentPersonalIncome	-1,044	3,203	-6,655	-4,824	-26,961**	-18,780
	(3,480)	(4,804)	(7,441)	(8,047)	(12,989)	(15,512)
K12Enrollment	-0.000352	-0.00346	-0.0419**	-0.0156	-0.0841**	0.00610
	(0.0113)	(0.0126)	(0.0172)	(0.0101)	(0.0396)	(0.0172)
PerCapitaIncome	0.00334	0.00333	0.000426	-0.00729	-0.00921	-0.0445***
	(0.00336)	(0.00461)	(0.00525)	(0.00498)	(0.00955)	(0.0151)
TaxValTotalPop	0.0291***	0.0334***	0.0822*	0.0437	0.198**	0.0661
	(0.00885)	(0.00991)	(0.0446)	(0.0417)	(0.0922)	(0.0762)
MedianHouseValue	-0.000242	0.000633	-0.00155	-0.00519**	0.000756	-0.00989**
	(0.000894)	(0.000751)	(0.00190)	(0.00203)	(0.00438)	(0.00395)
HomeOwnRate	-0.550	-0.390	-0.737	-1.524	31.42	28.94*
	(2.856)	(2.783)	(4.952)	(3.939)	(20.95)	(16.31)
PercentBachDegree	-0.804	-1.334	2.246	-4.100	-10.44	-32.58*
	(3.895)	(4.102)	(5.549)	(5.407)	(17.20)	(16.66)
Constant	-4.739	-229.9	1,567***	2,047***	4,245**	5,862***
	(298.8)	(375.7)	(540.8)	(500.5)	(1,606)	(1,275)
Observations	742	742	742	742	742	742
R-squared	0.040	0.078	0.492	0.613	0.558	0.724
Number of Counties	53	53	53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table E.2. PropTaxRelief1Allocation, PropTaxRelief2Dummy, & PropTaxRelief2SchoolDist on CAPEXPPP, ADMEXPPP, and STFALPP

MODELS	(1) CapOutlaysPPExp Fixed Effects	(2) CapOutlays PPExp Two-Way Fixed Effects	(3) AdminPPExp Fixed Effects	(4) AdminPP Exp Two-Way Fixed Effect	(5) StaffPPExp Fixed Effects	(6) StaffPPExp Two-Way Fixed Effects
PropTaxRelief1Allocation	2.60e-06	-7.67e-07	1.03e-05***	-3.82e-07	3.91e-05***	-3.42e-06
	(2.01e-06)	(2.84e-06)	(3.61e-06)	(2.91e-06)	(1.43e-05)	(6.30e-06)
PropTaxRelief2Dummy	-66.19	-208.1	236.0*	1,315***	1,123***	4,915***
	(60.10)	(129.3)	(136.6)	(201.2)	(365.0)	(664.3)
PropTaxRelief2SchoolDist	0.258	0.359	-5.072*	-3.713	-9.889	-3.496
	(0.952)	(1.146)	(2.531)	(2.308)	(10.64)	(7.682)
PropTaxPercentPersonalIncome	-622.8	3,019	-6,197	-3,258	-28,896**	-18,399
	(3,566)	(4,805)	(7,016)	(7,301)	(13,069)	(14,782)
K12Enrollment	-0.000953	-0.00315	-0.0424**	-0.0183*	-0.0811*	0.00534
	(0.0113)	(0.0124)	(0.0178)	(0.00992)	(0.0405)	(0.0157)
PerCapitaIncome	0.00361	0.00322	0.000325	-0.00633	-0.0110	-0.0441***
	(0.00338)	(0.00462)	(0.00501)	(0.00444)	(0.00942)	(0.0152)
TaxValTotalPop	0.0303***	0.0327***	0.0845*	0.0498	0.195**	0.0686
	(0.00908)	(0.00994)	(0.0464)	(0.0446)	(0.0925)	(0.0796)
MedianHouseValue	-0.000393	0.000637	-0.00111	-0.00518**	0.00244	-0.00975**
	(0.000817)	(0.000699)	(0.00180)	(0.00201)	(0.00427)	(0.00396)
HomeOwnRate	-0.254	-0.433	-1.289	-1.238	28.65	28.70*
	(2.815)	(2.743)	(5.237)	(3.947)	(21.80)	(16.80)
PercentBachDegree	-1.080	-1.387	3.677	-3.449	-6.357	-31.66*
	(3.891)	(4.122)	(5.900)	(5.868)	(17.56)	(17.57)
Constant	-39.78	-214.0	1,531***	1,909***	4,409**	5,821***
	(304.4)	(378.5)	(555.8)	(465.7)	(1,714)	(1,267)
Observations	742	742	742	742	742	742
R-squared	0.039	0.078	0.496	0.617	0.555	0.725
Number of Counties	53	53	53	53	53	53

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from these above tests show relatively weak conclusions about the effect of either of the two primary independent variables and their effects on each of the dependent variables. Essentially none of the models are statistically significant for either PropTaxRelief2County or PropTaxRelief2SchoolDist when two-way fixed effects are included. This is the case even though R-squared values for AdminPPExp and StaffPPExp are higher for both sets of models as compared to the models run on the dependent variables CCPCOEALLEXP and CostPPExp. These results, though interesting if significance was found, provide no additional information to what has already been derived.