An Historical Analysis of Fiscal Equity in the Commonwealth of Virginia: 2004-2018

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ABSTRACT

This research examines the horizontal and vertical equity of public school funding in the Commonwealth of Virginia from 2004 to 2018. This study analyzed and measured the horizontal and vertical equity funding allocations across each reporting division in the Commonwealth of Virginia from FY2004 to FY2018 in two-year increments reflective of the final year in each biennium where the local composite index (LCI) is calculated. Data were collected for the 132 reporting divisions in the Commonwealth of Virginia including funding amounts, student counts, categorical counts, and average daily membership. Weights were applied to specific groups within the study (i.e., economically disadvantaged students, special education students, and English language learners) in order to obtain vertical equity measures. The chosen measures of wealth neutrality and fiscal equity were range, restricted range, restricted range ratio, coefficient of variation, the Theil Index, the Pearson Correlation, regression, slope, elasticity, the Gini Coefficient, and the McLoone Index. At fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016 and 2018, the measures were used to analyze the selected data points for each district across the Commonwealth of Virginia with both unweighted and weighted values. Over the duration of the study, both horizontal and vertical equity measures decreased overall. The information from these analyses will help inform researchers and educational leaders about the current state of equity for divisions across the Commonwealth of Virginia.

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GENERAL AUDIENCE ABSTRACT

This research examines the equity of public school funding in the Commonwealth of Virginia from 2004 to 2018 two different ways. First, the research measures equity where every student is mathematically identical, which is how funding currently works; this is called horizontal equity. The second measure of equity in this research applies mathematical weights of different amounts to students with different classifications that historically cost more to educate (i.e., economically disadvantaged students, special education students, and English language learners) (Berne & Stiefel, 1984; Verstegen & Knoeppel, 2012); this is referred to as vertical equity. This study analyzed and measured the horizontal and vertical equity funding allocations across each reporting division in the Commonwealth of Virginia from fiscal year 2004 to fiscal year 2018 in two-year increments. This is because every two years, the amount of funding a division receives is recalculated as is the division's ability to pay, also known as the local composite index (LCI). For the purposes of this study, the final year of each two-year cycle was analyzed. Data were collected for the 132 reporting divisions in the Commonwealth of Virginia including funding amounts, student counts, categorical counts, and average daily membership. Weights were applied to specific groups within the study (i.e., economically disadvantaged students, special education students, and English language learners) in order to obtain vertical equity measures. At fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016 and 2018, the statistical measures were used to analyze the selected data points for each district across the Commonwealth of Virginia with both unweighted and weighted values. Over the duration of the study, both horizontal and vertical equity measures decreased overall. The information from this study will help inform researchers, educational leaders, and other stakeholders about the current state of equity for divisions across the Commonwealth of Virginia.

Dedication

This dissertation is dedicated to my daughter, Chloe Van der Linden, who battled pediatric cancer while this was being written. Before you were ever born, I knew I wanted to achieve this accomplishment for you. I always wanted you to see that women are strong and can achieve anything. Little did I know that you would show me the exact same thing as you battled and beat cancer. Remember that there is no limit to what you can achieve.

Additionally, I would like to dedicate this to my husband, Brian. I know you don't like to think of this as your dissertation as well, but it is. The late nights, weekend writing sessions, library trips, and fiscal equity conversations were sacrifices that you had to make in order to help me achieve my goals. Your name appears in this dissertation because you were a large part in my successful completion of it, and I cannot thank you enough. I love you beyond measure.

Lastly, I wish to dedicate this to my mother, Jacki. I have gained much of my professional drive from you. I watched you raise three kids as a single mother without complaint and I watched you find success and fulfillment in your work along the way. I am positive that I gained my work ethic from you and I owe you words of gratitude for being a constant reminder that I could be successful in life. Your words of affirmation never left my mind, and I hope to continue to instill those beliefs in those around me. You helped me become the first member in our household to graduate from college, and now complete a doctorate. Thank you for everything, mom; I love you.

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what I needed to not only feel more secure in what I was doing, but also in completing it. You may never know how indebted I am to you, but I hope this statement of gratitude conveys how much your support meant to me.

Lastly, I would like to thank my Hampton Roads VT cohort members for your continued friendship and encouragement over the last few years. I look back fondly on our OTRs, classes, working lunches, and other collaboration. I am eternally grateful for having had the opportunity to learn from and grow alongside each of you. Every one of you inspired me throughout this process, and I celebrate each of you as you continue down your own paths beyond our program. I look forward to seeing how much you all accomplish. You will forever be my Hokie family.

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Chapter 1
The Problem

Introduction

There have been many instances throughout the history of public education where stakeholders and constituents have challenged the fairness or equitability of school funding, including Virginia. Virginia, made up of 135 school districts, has had a relatively consistent method for calculating local districts' ability to pay since the late 1980s (Alexander & Salmon, 2019). Such consistency allows for longitudinal analyses to be conducted on the methods and means of funding public education in the Commonwealth of Virginia and their equitability. Previously, an equity study was conducted by Dr. Terry Arbogast, II (2005), but there has not been another similar study conducted since then.

The 135 school divisions in the Commonwealth of Virginia vary in size, setting, and make up to include rural, suburban, and urban districts. Each division has an array of students with varying needs and accommodations such as economically disadvantaged students, special education students, and English language learners. Of the 135 divisions in the Commonwealth of Virginia, only 132 divisions are reporting divisions for fiscal measures, as the remaining three are combined with other divisions for reporting from the Virginia Department of Education; these divisions are Fairfax City and Fairfax County, Emporia and Greenland County, and Williamsburg and James City County. The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018.

Equity can be simply understood as fairness (Springer, 2008). This concept of fairness permeates into the discussion of equitability of school funding and whether or not each student is provided a fair opportunity for success from a financial perspective Springer, 2008). Fiscal equity is all but a simple concept, however. Fiscal equity is generally referred to as either horizontal or vertical equity (Owings & Kaplan, 2012). Horizontal equity is the equal treatment of unequals; this means each individual student is treated mathematically equal despite differing costs of education (Verstegen, 2013). Vertical equity is the unequal treatment of unequals; this means individuals are treated differently specific to their unique educational needs (Verstegen, 2013). Achieving fiscal equity would indicate a presence of fiscal neutrality (i.e., a lacking

correlation between per-pupil expenditures and a locality's ability to pay) from both horizontal and vertical measures (Ladd et al., 1999).

According to the Superintendent's Annual Report for FY2018, Virginia spent $16.14 billion on education; the state covered $5.36 billion and the localities covered $8.31 billion of that total (VDOE, 2019). On average, local districts spent $6,462 per pupil, the state allocated $4,166 per pupil, $1.052 per pupil came from retail and use tax, and $867 per pupil came from the federal government (VDOE, 2019). Combined, the average cost per pupil was $12,548 (VDOE, 2019). Since 2008, local governments have assumed more responsibility for funding public education from having allocated 48.6% of funding on education in the 2008-2009 school year to 51.3% in the 2016-2017 school year (Duncombe, 2018). According to a report on the Commonwealth Institute, state direct aid has fallen by 9% since 2009, student population has grown by 53,376, and there are 1,242 fewer staff members across school divisions (Duncombe & Cassidy, 2018). Based on 2017 data reporting, Virginia ranks ninth in the nation for percent of revenue allocated by the local government to public education and forty-third for percent of state revenue allocations (NEA, 2018).

A number of factors can adversely affect the distribution of funds, including family income, setting of school (e.g., rural or urban), local economic makeup, number of students receiving specialized instruction, and geographic conditions (Berne & Steifel, 1992; Verstegen & Knoeppel, 2012). With the localities assuming more responsibility in funding public education in the Commonwealth since the Great Recession of 2007, lower income school districts who may have one or multiple factors of adversity often find themselves falling short in providing equitable educational services to students when they are compared to larger and more affluent districts (Lachman, & Mai, 2014). According to the Composite Index of Local Ability-to-Pay for the 2018-2020 biennium, Arlington, which is one of the wealthiest districts in the Commonwealth of Virginia, reported a true value of property of $75,174,841,517 (VDOE, 2017). Arlington also reported an average daily membership (ADM) of 24,210, and a total population of 234,678 (VDOE, 2017). For the same biennium, the poorest district in the Commonwealth of Virginia, Lee County, reported a true value of property of $1,154,579,893, an ADM of 3,064, and a total population of 25,182 (VDOE, 2017). Arlington reported having 28% of its student body classified as economically disadvantaged during the 2019-2020 school year while Lee County reported 52% the same year. Arlington had a fiscal capacity (or LCI) that was

capped at 0.8000 while Lee County's LCI measured at 0.1701. Lee County had over half of its student body identified as economically disadvantaged, but lacked the same ability to pay due to having a smaller population, lower property value, and less revenue from sales than Arlington. This is because division spending is driven by student population, in part, derived from the reported average daily membership (JLARC, 2017). Arlington's uncapped LCI is calculated at 1.2564, suggesting the division's ability to autonomously fund schools without additional aid; however, Arlington still receives a portion of aid in the name of equity. The next sections of this chapter further discuss the formula for calculating the fiscal needs of each division in the Commonwealth of Virginia and provides more information on the capping of the local composite index.

Overview of the Study

This longitudinal study examined local and state funding allocations over the course of fourteen years beginning in 2004 and spanning through 2018 for the Commonwealth of Virginia. At fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018, data points were drawn from each reporting division across the Commonwealth. Each chosen data point reflects the second year of a biennial period as it pertains to the calculation of the local composite index (LCI). This study measures changes in school finance equity over the fourteen-year period with the intention of providing insight to educational leaders and researchers for potential areas of improvement in fiscal equity measures. A concerted focus was placed on both horizontal and vertical equity measures in order to present a more detailed analysis of equity across the selected years. Using the identified years of study, a comparative analysis was conducted to examine the relationship between horizontal and vertical equity measures across divisions in the Commonwealth of Virginia from 2004 to 2018.

Historical Perspective: Virginia's Conditions

Since courts determined that education is not a right under the United States Constitution (*San Antonio Independent School District v. Rodriguez*, 1973), the majority of the responsibility for funding public education rests with the states. Virginia's K-12 public education funding infrastructure draws from three funding sources: federal, state, and local government funding. The Commonwealth must adhere to the Standards of Quality (SOQ) when appropriating educational funding. Established in 1971, the SOQ provides minimum standards of quality for

the Board of Education to include staffing ratios, maximum class sizes, licensure requirements, and program funding among others (JLARC, 2017). According to Salmon and Alexander (2019), the SOQ is divided into seven different standards to include the following: (1) instructional programs, (2) instructional, administrative, and support personnel, (3) accreditation and evaluation, (4) student achievement and graduation requirements, (5) teacher quality and educational leadership, (6) planning and public involvement, and (7) school board policies (Code of Virginia). The SOQ identifies minimum requirements for funding per-student across eleven categories identified in Figure 1.

Figure 1

SOQ Separate Funding Categories of Public Schools (Salmon & Alexander, 2019)

Basic State Aid

- One cent Dedicated State Sales Tax
- Textbooks (Split-Funded)
- Vocational Education
- Gifted Education
- Special Education
- Prevention, Intervention, and Remediation
- VRS Retirement
- Social Security
- Group Life Insurance
- English as a Second Language

Since the 1974-1975 school year, Virginia has utilized a measure of fiscal capacity, or ability to pay, to determine how funds are allocated across the state. The method of calculating this measure, known as the Local Composite Index (LCI), has remained relatively unchanged since the 1988-1989 school year and is used when determining shared costs between local districts and the Commonwealth (Alexander & Salmon, 2019; Verstegen, 1989;). Figure 2 shows the current breakdown of the LCI formula.

Figure 2

Local Composite Index in the Commonwealth of Virginia

ADM Component=

$$0.5 \times \left[\frac{\frac{\text{Local True Value of Property}}{\text{Local ADM}}}{\frac{\text{State True Value of Property}}{\text{State ADM}}}\right] + 0.4 \times \left[\frac{\frac{\text{Local Adjusted Gross Income}}{\text{Local ADM}}}{\frac{\text{State Adjusted Gross Income}}{\text{State ADM}}}\right] + 0.1 \times \left[\frac{\frac{\text{Local Taxable Retail Sales}}{\text{Local ADM}}}{\frac{\text{State Taxable Retail Sales}}{\text{State ADM}}}\right]$$

Population Component=

$$0.5 \times \left[\frac{\frac{\text{Local True Value of Property}}{\text{Local Population}}}{\frac{\text{State True Value of Property}}{\text{State Population}}}\right] + 0.4 \times \left[\frac{\frac{\text{Local Adjusted Gross Income}}{\text{Local Population}}}{\frac{\text{State Adjusted Gross Income}}{\text{State Population}}}\right] + 0.1 \times \left[\frac{\frac{\text{Local Taxable Retail Sales}}{\text{Local Population}}}{\frac{\text{State Taxable Retail Sales}}{\text{State Population}}}\right]$$

$$\text{LCI} = (\mathbf{0.6667}) \times (\mathbf{0.3333} \times \boldsymbol{\text{Population Component}}) \times \mathbf{0.4500})$$

The LCI is recalculated every two years and uses three measures of fiscal capacity: true valuation of real and public service corporations, adjusted gross income, and taxable sales receipts (Salmon & Alexander, 2019). The LCI across the 135 districts in the Commonwealth of Virginia for FY2017-2018 in the Commonwealth ranged from 0.8000 (Alexandria, Arlington, Bath, Fairfax, Falls Church, Goochland, Highland, & Surry) to 0.1754 (Lee County); some divisions have a higher measure of fiscal capacity to extend beyond 1.0000, but LCI is capped at 0.8000 in order to ensure all districts, even those with higher fiscal capacities, are still awarded aid. However, the LCI is projected using dated data, which do not always account for the current fiscal conditions for a calendar year. This can adversely affect lower capacity districts when compared to higher capacity districts. For example, the LCI calculated for use between 2018 and 2020 is based on information from 2015 and the average daily membership (ADM) counts are from 2016 (Salmon & Alexander, 2019). Additionally, LCI is a measure where districts are compared across the Commonwealth rather than an individualized consideration of the economic conditions an individual locality may be facing. This could lead to a rise in the LCI for a district facing deteriorating conditions if other districts of higher volume and population are facing similarly deteriorating conditions (Salmon, 2010).

In addition, Virginia has a substantial fiscal capacity or ability to pay (Salmon & Alexander, 2019). According to the Bureau of Economic Analysis, Virginia ranked 13th in the

nation in per capita personal income in 2019 (2020). Despite its fiscal capacity, Virginia does not have a comparable degree of fiscal effort (actual expenditures in relation to income). According to Salmon and Alexander (2019), Virginia had its lowest rank of fiscal effort in almost forty years during the 2016-2017 school year. Among the states Virginia ranked 35th in the nation for fiscal effort at $33 per $1,000 of income for the 2016-2017 school year. In contrast, Virginia previously ranked higher at 22nd in the nation with a fiscal effort of $42 per $1,000 of income during the 2006-2007 school year ten years prior (Salmon & Alexander, 2019).

Statement of the Problem

The landmark ruling of Brown v. Board of Education ordered all schools to desegregate with *all deliberate speed* and found racially segregated schools to be unconstitutional (Brown v Board of Education, 1954). While today's schools are not racially segregated as they were pre-Brown v. Board of Education, a case may be made for existing fiscal segregation. As the nation becomes more diverse, the nation also finds an increase in segregation by race and/or class (Orfield & Frankenberg, 2014). This is especially true for non-affluent Black and Latino students when compared to affluent White and Asian communities in the country. Thus, a case can still be made for the funding disparities that exist between more affluent and poorer districts (Duncombe, 2017).

School funding amounts and allocations are based on geography. Schools rely heavily on taxes and property wealth to fund their schools, causing problems for areas with high concentrations of poverty or lacking property wealth. Historically, schools in Virginia have been funded locally. In doing this, the responsibility of fully funding education for students places an unequal burden on districts throughout the Commonwealth based on their wealth. Data from The Commonwealth Institute illustrate that non-affluent districts in the Commonwealth, such as Lee County, were able to fund 8.5% above the locally required effort. Conversely, the more affluent districts in the Commonwealth, such as Fairfax County, were able to fund 117.5% above the locally required effort (Duncombe & Cassidy, 2018).

All divisions across the Commonwealth, including Lee County and Fairfax County, are required to meet the same standards of quality in the current era of accountability despite the disparities in fiscal support available. More funding provides more opportunities to students in the form of staff, programs, enrichment, and other means of educational support (Baker, 2016). Funding disparities like this exist across the Commonwealth as do disparities in student

achievement and school divisions have increased pressure to do more with less or to make ends meet rather than receive equitable financial support (Duncombe, 2017). A longitudinal analysis of the funding practices across the Commonwealth of Virginia will better inform policy and practice of funding districts equitably.

Rationale and Significance of the Study

The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. A similar study was previously conducted measuring equity across divisions in the Commonwealth of Virginia from 1976-2003 (Arbogast, II, 2005). This study examined fluctuations in the Commonwealth's horizontal and vertical fiscal equity over the course of a fourteen-year period. In order to successfully complete this study, appropriate definitions of horizonal and vertical equity must be established. Once established, appropriate statistical measures must be outlined with attention to how they inform the researcher about fiscal equity. Then, data must be collected for each district in the Commonwealth of Virginia from fiscal years 2004 to 2018 at fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018 in spreadsheets via Microsoft Excel. Once collected, the statistical analyses will be conducted in order to quantify and graph equity measures for easier interpretation. The information and data collected enable the researcher to analyze how horizontal and vertical fiscal equity measures have trended over a predetermined period of fourteen years. Furthermore, it allows the researcher to mathematically determine whether or not horizontal and vertical fiscal equity measures have risen, fallen, or maintained over a fourteen-year period.

The significance of this study is twofold. A similar study was previously conducted by Arbogast (2005) where the fiscal equity was analyzed from 1974 to 2003. This study intends to continue the analysis of fiscal equity measures in the Commonwealth of Virginia in a longitudinal manner but include measures for both horizontal and vertical equity. Additionally, this study aims to provide insight to school administrators, policy makers, legislators, school boards and other school officials about recent and current fiscal equity conditions. This research will contribute to the ongoing conversation of equitable school funding in the Commonwealth of Virginia.

Research Questions

Research Question 1: How has the horizontal equity of school funding changed in the Commonwealth of Virginia since 2004?

Research Question 2: How has the vertical equity of school funding changed in the Commonwealth of Virginia since 2004?

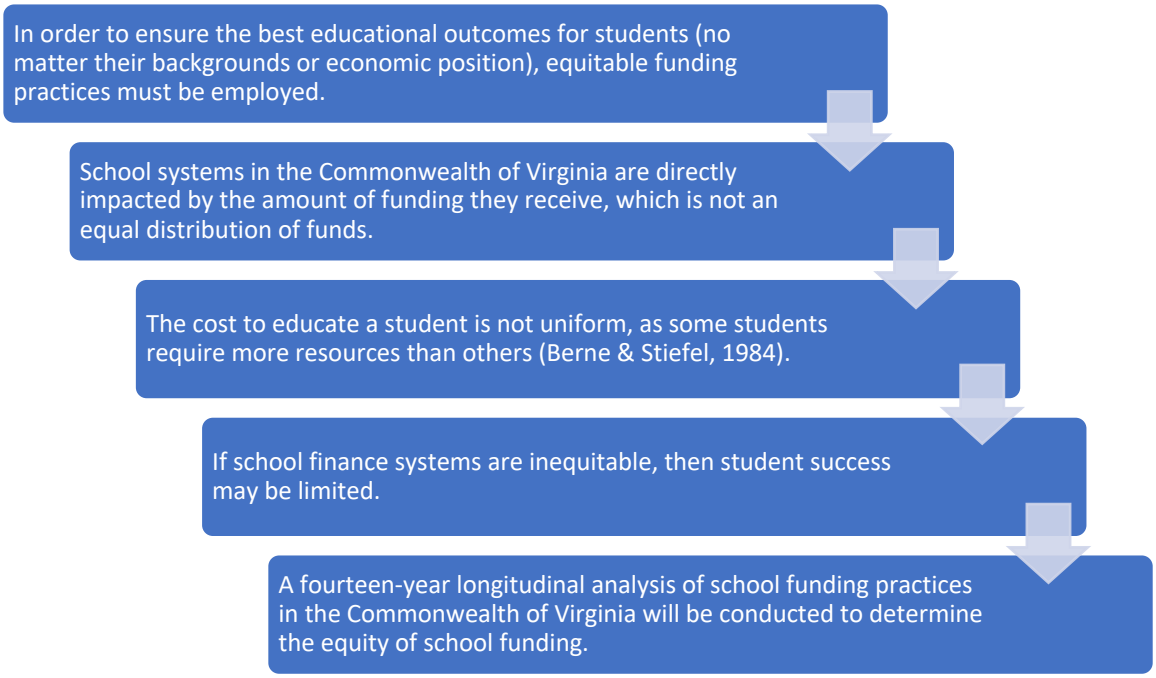
Conceptual Framework

James Madison believed "knowledge [is] the most important property that man possesses, and each generation has the obligation through education to pass all that property on to succeeding generations" (Alexander & Alexander, 2012, p. 33). Furthermore, this belief was expanded by Benjamin Rush, who said "… a free and uniform system of education that would 'render the mass of the people more homogeneous, and thereby fit them more easily for uniform and peaceable government'" (Alexander & Alexander, 2012, p. 30). The operative term in these statements is uniform, which encompasses all aspects of education, especially the equitable funding of it. A previous study was conducted (Arbogast, 2005) to analyze the fiscal equity for the Commonwealth of Virginia from 1976 until 2003. Continuing the conversation of equity beyond the previous years analyzed will give a more current snapshot of equity measures in across the Commonwealth of Virginia. Additionally, measuring for both horizontal and vertical equity will provide more information about the state of school funding in the Commonwealth of Virginia.

This study follows what may be referred to as the staircase of fiscal equity. Illustrated in Figure 3, it may be regarded as a descending staircase, beginning with broad claims and descending to a narrower point of focus. The tenets of this descending staircase of fiscal equity are outlined in Figure 3.

Figure 3

Conceptual Framework of the Study



School finance systems should be designed in a way that ensures best educational outcomes for students regardless of their backgrounds or levels of poverty. Evans et al. (2014) stated the Great Recession "…was the most severe economic downturn in the United States since the Great Depression" (p. 2). This downturn negatively impacted school divisions but impacted them in a disproportionate manner. There are inequitable funding practices across low and high poverty districts that disproportionately affect low income areas, students in poverty, and bilingual students (Baker, 2014; Knight, 2017). A recent study suggests school finance systems have historically become less equitable periods of recession (Baker, 2014; Evans, Schwab, & Wagner, 2017). Those inequities often impact high-minority and high-poverty districts in a disproportionate manner (Knight & Strunk, 2016). Research continues to support that increasing spending on education leads to better student outcomes (Baker, 2015; Gjaja, Puckett, & Ryder, 2014). The last time a longitudinal analysis of fiscal equity in the Commonwealth of Virginia was conducted was in 2005 (Arbogast); that analysis was a measure of horizontal equity, as it did not include applied weights to account for vertical equity. However, Arbogast (2005) did conclude that from 1974 to 2003, the horizontal equity of school funding increased. Therefore, conducting a longitudinal analysis of horizontal and vertical fiscal equity can provide an update

on the state of the equity of the Commonwealth's funding practices. It can also begin to inform policy and practice for school funding in the Commonwealth to secure best outcomes for students.

Definition of Terms

There are terms that can be found throughout this dissertation related to the topic discussed. These terms include the following:

adjusted per pupil expenditures - the allocated per pupil expenditures in each reporting division in the Commonwealth of Virginia with the federal funds excluded.

fiscal adequacy - the variation in the allocation of resources to the educational needs of students (Ladd et al., 1999).

fiscal capacity - the financial resources available to fund services; a measure of wealth determining a locality's ability to pay (Owings & Kaplan, 2012, p. 131)

fiscal effort - how much a locality spends in relations to its ability to pay (i.e., fiscal capacity) (Owings & Kaplan, 2012)

fiscal equalization program - "establishes a base program cost for each locality… from which a local tax effort is deducted" (Salmon, 2010, p. 147).

fiscal equity - fairness in the distribution of educational goods and services (Springer, 2009).

fiscal neutrality - a lacking correlation between a locality's wealth and its expenditures (Alexander, Salmon, & Alexander, 2015).

heterogenous variability - also referred to as heteroscedasticity, occurs when there is a large variance between the variance of a data set (Howell, 2013).

Millage - tax rate applied to property; used to determine required local effort; one mill equals $0.001 (Salmon & Alexander, 2019).

real resources - teacher education, teacher experience, and teacher-pupil ratios (Hanushek, 1997).

reporting divisions - refers to the divisions that are reported in Table 15 of the Superintendent's Report for the Commonwealth of Virginia. Despite having 135 school divisions, only 132 divisions are reporting for fiscal purposes, as some divisions are combined for fiscal measures (i.e., Fairfax City and Fairfax County, Emporia and Greenland County, and Williamsburg and James City County).

Delimitations and Limitations

One delimitation of this study is the study maintains a narrow focus by only considering fiscal equity and policy decisions in the Commonwealth of Virginia during a set number of years (i.e., 2004-2018). Therefore, the generalizability of this study would be limited to the Commonwealth of Virginia unless adjustments were made to reflect other state formulas and funding practices.

One limitation of this study is that in the data collected, students are all considered to be equal in number, despite that they are not all equal from a funding perspective (Brimley et al., 2012, p. 53). For instance, students with special needs are not necessarily dispersed evenly among schools or districts, despite the fact that they require additional funding when juxtaposed with students who do not have special needs. The study took measures to theoretically equalize students with higher costs for education (i.e., economically disadvantaged students, special education students, and English language learners), but it is not an exact equalization. An additional limitation of the study is the data being analyzed was collected from outside parties and institutions rather than the researcher. While the data is widely accepted as valid (as it is published on state websites and used for state reporting), it remains secondary data which is collected by parties other than the researcher.

Organization of the Study

The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. The first chapter identifies the problem and introduces the reader to the topic of fiscal equity by providing a brief summary of the subject. This chapter also includes research questions, a purpose statement, delimitations, limitations, and the study's conceptual framework.

The second chapter provides a review of the literature concerning the topic of horizontal and vertical fiscal equity both on a national level and a state level. This briefly extends into conversations surrounding the topic of adequacy, as well, for the purpose of addressing the topic and how it relates to equity. The study does not extensively discuss adequacy, however, since the primary focus of the study is concerned with the topic of equity.

Chapter three introduces the methods of the study. This study utilized quantitative methods to mathematically measure the equity of finance across the Commonwealth of Virginia

over a fourteen-year period. A justification for the chosen research design is provided, as well. Furthermore, the research questions are reintroduced, and the sources of data surveyed are identified.

Chapter four includes the results of the analysis of the data. The findings are reported and the data described, but there is not be in-depth discussion of what conclusions may be drawn from the data (as this will be discussed in Chapter 5). Lastly, any patterns or themes are identified as they pertain to the statistical measures utilized.

Chapter five concludes the study and discussion of the study. The findings of the study, a general summary, and conclusions are also discussed. From this discussion, implications of what the findings suggest are raised. Lastly, suggestions for future research are identified along with any other conclusions not previously reached.

Chapter 2
A Review of the Literature

Background

The structure of Virginia's school finance system has had few changes over the years with few changes in policy. Established with the Virginia Literary Fund in 1810, the Commonwealth lacked an official means for providing substantial funding for education prior to that point (Salmon, 2010). Originally, the Virginia Literary Fund was funded through repayment methods for the War of 1812 (e.g., penalties, fines, escheats forfeitures, confiscations), but has since evolved to include more specific sources:

> …the proceeds of all public lands donated by Congress for free public school purposes, of all escheated property, of all waste and unappropriated lands, of all property accruing to the Commonwealth by forfeiture except as hereinafter provided, of all fines collected for offenses committed against the Commonwealth, and of the annual interest on the Literary Fund; and such other sums as the General Assembly may appropriate (Constitution of Virginia, Article VIII).

According to Salmon (2010), the Literary Fund has consistently been tapped to help pay for varying purposes apart from the general funding of public schools. Whether it be for aid in funding the establishment of the University of Virginia in 1819, or for other purposes, the Literary Fund could be considered to be inconsistent and unreliable as a steady source of educational funding (Salmon & Alexander, 2019).

In 1870 the president, John C. Underwood, presented an article stating the General Assembly would provide free and compulsory education for the youth aged 5-21 in the Commonwealth (Constitution of Virginia, 1869) at the rate of not less than one mill and not more than five mills. Salmon (2010) described this value to equal "not less than $0.10 per $100 of assessed value and not more than $0.50 per $100 of assessed value" (pp.145-146). Even after this mandate, it still remained that schools were still poorly funded, especially non-white schools. This led to debate about how non-white students would be educated, resulting in the establishment of two systems of public schools: one for white students and another for non-white students. Neither systems of schooling were adequately funded, however, with non-white students facing more unsatisfactory conditions than their white counterparts (Salmon & Alexander, 2019).

At the turn of the 20th century, the Virginia Constitution was rewritten; compulsory education remained, but the range of ages to be educated reduced to 7-20 years old (Constitution of Virginia, 1902). It was also at this time that the issues caused by the diversion of funds from the Literary Fund came to light. Salmon (2010) reported that there was a "considerable variance in the fiscal ability of localities to support governmental services, including their ability to fund public free schools…" (p.147). As a result, the General Assembly created a "statewide system of public schools and increased state appropriations" (Salmon & Alexander, 2019, p. 22). This led to racial and ethnic inequities due to the variance in localities' ability to fund schools according to governmental regulations. Thus, the Basic State School Fund was created.

In 1966 a sales tax was instituted at a rate of $0.03 per $100, where $0.01 of the total would be designated to public schools and the other $0.02 would be placed in a general fund (Salmon & Alexander, 2019). Shortly after, however, a case, *Burruss v. Wilkerson* (1969) challenged the constitutionality of those funding measures for the Commonwealth. In 1971, the state constitution was redrafted again to include the Standards of Quality (SOQ). This redrafting came at the same time as the first landmark fiscal equity case of *Serrano v. Priest* (1971) where the California school finance system was found to be unconstitutional. The SOQ placed a focus on the implementation of a new funding formula and required school districts to meet minimum funding standards; thus, the Local Composite Index (LCI) method of fiscal measurement was created. The LCI is a combination of a measurement of wealth, property, income, and sales taxes (Salmon, 2010). Ranging from 0.0 to 1.000, the LCI is a determination of a district's ability to pay. The LCI was initially used during the 1974-1975 school year. Originally, both local and state shares were mathematically equalized at 50% and the "state-calculated cost of Basic State Aid was based upon a fixed number of instructional personnel per 1,000 pupils in average daily membership (ADM) plus support expenditures per-pupil in ADM (roughly a 60/40 instruction/support ratio)" (Salmon & Alexander, 2019, p. 27). These costs were recalculated every two years at a fixed amount, proving problematic for districts with variance in educational needs and economic circumstances across the state. Variances in educational needs result from the number of students requiring specialized instruction, such as special education services or gifted and talented services. Variance in economic circumstances may result from cost of living, population density, size of schools, etc. (Salmon & Alexander, 2019).

According to Salmon (2010), "almost immediately following the implementation of the SOQ system, critics complained that the state was not fully funding its share…" (p. 152). As a response to criticism of the SOQs, the Joint Legislative Audit and Review Commission (JLARC) released two reports (JLARC, Part I in 1986 & JLARC, Part II in 1988) demonstrating whether or not the state was meeting its fiscal requirements set forth by the General Assembly. Results of the first report gave minor suggestions for revenue increases, but the second report gave more substantial suggestions for increases in state allocations in addition to altering the system of school finance. As a result of the two JLARC reports, the state's LCI was adjusted to reflect a 55/45 percent state/local shares (Salmon & Alexander, 2019). Since LCIs are recalculated every two years, there are notable fluctuations in sources which can have a ripple effect on funding. For example, three high volume areas in the Commonwealth have a great mathematical influence on LCI calculation (i.e., Hampton Roads, Richmond, & Northern Virginia). Any increase or decrease in economic indicators in these areas has a ripple effect on the rest of the state's LCIs. Additionally, LCIs are calculated on dated information; this can result in disparities between reported fiscal capacity and actual capacity of districts (Salmon, 2010).

In 2001, another JLARC report was released. The report stated that funding practices across the Commonwealth left noticeable gaps. In the coming years, legislators worked together to attempt to close the gaps that were found in school funding; while they created substantial increases, disparities still persisted. Since then, The Great Recession of 2008 had a profound effect on school funding where various budget reduction strategies were implemented (e.g., hiring freezes, salary freezes, elimination of positions, early retirement incentives) (Salmon, 2010, pp. 159-160).

Inequity in education has impacted the United States for years; this can be demonstrated through the presence of achievement gaps in data reporting (Tavernise, 2012) as well as the growing number of court cases disputing equity. In 2015, Taylor indicated that, forty-six of the fifty states had "challenged the constitutionality of school funding formulas" with no reprieve in sight (p. 248). Simply put, "There is considerable variation from community to community in terms of the quality of schools, the needs of students, and the availability of resources," which leaves educational leaders and other stakeholders seeking solutions (Brimley, Verstegen, & Garfield, 2012, p. 8). Equity, from a school funding perspective, is the measurement of difference between per-pupil funding or expenditures. Brimley, Verstegen, and Garfield (2012)

suggested that "if per-pupil funding or expenditures vary by an amount of five to ten percent, then equity is achieved" (p. 52). After reading the literature, it is evident that the concept of having fair and equitable schools and financial policies is not foreign to the modern educational leader. Dating back to the trailblazer case of Brown v. Board (1954), the discussion of what constitutes fair in education is one that has been prominent in national litigation and continues to be discussed. Specific to the subject of financial equity, there have been cases to challenge finance systems in states across the country for more than forty years, beginning with *Serrano v. Priest* in 1971 (Owings & Kaplan, 2013).

In Virginia, there have been two cases that have challenged the educational finance structure: *Burruss v. Wilkerson* (1969) and *Scott v. Commonwealth* (1994). In *Burruss v. Wilkerson* (1969), the claim addressed a flaw in the funding formula that was causing funding discrepancies across the Commonwealth, thus violating the equal protection clause under the Fourteenth Amendment of the U.S. Constitution. While the courts ruled in favor of the defendant and denied the claim, it was further noted that the issue of funding discrepancies would be further analyzed, leading to the creation of a funding system. The second case, Scott v. Commonwealth (1994), also challenged the funding formula of the Commonwealth. Ultimately, it was found that education, while it is a fundamental right, does not face a requirement of equal funding. According to the courts, while it is a noble pursuit, equal funding of education is not a requirement under the Constitution.

Search Process

A quantitative longitudinal study was conducted in order to analyze fiscal equity from 2004 to 2018 in the Commonwealth of Virginia. Prior to conducting the study, information was gathered from research databases (e.g., ERIC, EBSCO, JSTOR), the Virginia Department of Education (VDOE) website, and the Commonwealth Institute. Additionally, dissertations on similar topics were collected and analyzed to support construction of the literature review.

The database searched most frequently was the Education Research Complete from EBSCOhost. When searching EBSCO, initial searches included the search terms "school finance" and "social justice". This search resulted in twenty results, which was not adequate enough. The researcher also found that many of the topics discussed were focused around the topic of adequacy rather than equity. An additional search included the terms "equity" and "social justice". While this resulted in substantially more resources (i.e., 1,555), the search

results were less focused and covered topics such as gender equity and equity of music teacher programs. After this search, the term "fiscal equity" was input, which yielded one-hundred-seven results. The final search input adjustment made by the researcher was adjusting the limiting filters in the database to include the most recent ten years which left twenty-three results. In addition to reviewing research, studies of fiscal equity were examined for multiple states. Fiscal equity analyses for Kentucky, Maine, New Mexico, Ohio, and Virginia were reviewed to help inform methodology decisions.

A Review of the Literature

The funding of America's public schools has been an area of concern in the country since 1642 when the first school finance-related law was passed in Massachusetts; lawmakers and citizens alike have been concerned with how to best fund the nation's schools for centuries (Owings & Kaplan, 2013). Even more, since the introduction of the practice of using property taxes to fund schools in 1647, there has been much debate on how to do so equitably (Owings & Kaplan, 2013). The paradox is that when it comes to educating the country's youth, "unequal dollars are required to produce equal educational opportunities" (Verstegen & Salmon, 1989, p. 211). It is fundamental for individuals to understand that equality and equity are not interchangeable terms. Treating a student as one may consider "equally" could, in many instances, be the antithesis of equity. As Brimley, Verstegen, and Garfield (2012) stated, "Equality means treating everyone the same. Equity means treating them fairly" (p. 50). Equity should be considered in two different manners: vertical and horizontal equity. According to Owings and Kaplan (2013), "*horizontal equity* states that people who are alike should receive equal funding shares" and "*vertical equity* states that the treatment of unequals requires appropriate unequal treatment" (p. 77). Simply stated, there are discrepancies that will exist in education where it is required to allocate varying levels of funds for varying purposes, and such discrepancies promote fairness. For example, Owings and Kaplan (2013) presented a scenario where two districts with differing percentages of students identified as eligible to receive special education services demonstrated when equality was not equity. The juxtaposed districts, one with 20% identified eligible for special education services and the other with 10%, have differing needs where the district with more students identified will require more funds in order to offer equal services (Owings & Kaplan, 2013). Taking this example into consideration, treating these two different groups of students equally versus equitably would be unfair due to the underlying

needs of the students in question (Brimley, Verstegen, & Garfield, 2012). Ultimately, ensuring students are all being given the same opportunity for success, regardless of their varying needs or the varying levels of resources required, is key in education finance.

Berne and Stiefel (1984) outline the basics of children's equity concepts into three categories to include inputs, outputs, and outcomes. When considering inputs, one can understand them to be what Berne and Stiefel call the "building" blocks" of education, as they include physical resources in either true dollar amounts or adjusted dollar amounts. The two most common inputs include revenues (the dollar amount received by divisions that will reach the student) or expenditures (the dollar amount spent on actual resources for the student). Outputs often refer to results on assessments or other performance measures, such as the Virginia SOL assessments or graduation rates. The final consideration, outcomes, relates to successes pupils find beyond K-12 education. These may be income, profession, or success in the job market. The belief is that if schools are equitable, students will leave K-12 education with the same opportunities for success regardless which division or school they attend (Berne & Stiefel, 1984).

From December 2007 through the summer of 2009, the United States economy faced what is known by economists as the Great Recession (Fowler, 2013). When the Obama Administration took office in 2009, a stimulus package was created and passed by Congress to help alleviate the financial difficulties experienced from the recession; this was known as the American Recovery and Reinvestment Act of 2009. A fair majority of this stimulus package went to the states, which the states allocated to school funding in an effort to avoid teacher layoffs and other burdens while also protecting instructional infrastructures. At the conclusion of the Great Recession, "tax revenues shrank and… public education began to sustain large budget cuts… [It was] predicted that the Great Recession would affect school funding for years to come…" (Fowler, 2013, p. 51). In fact, the effects of the Great Recession reverberated throughout the Commonwealth of Virginia for years after the Great Recession ended (Driscoll & Salmon, 2013).

Along with the complications caused by the Great Recession is the phenomenon of evolving demographic trends across the Commonwealth of Virginia. Since 1990, the Commonwealth has seen a steady increase in population. In 1990, the population was 6.19 million, in 2000 it was 7.08 million, and in 2010, it was slightly more than 8 million (Driscoll &

Salmon, 2013). Current projections suggest Virginia will be faced with a population greater than 8.5 million by 2025 (Driscoll & Salmon, 2013). With the growth in population across the state, Driscoll and Salmon (2013) referenced a projected growth in population diversity as well. The issue then becomes the ability of the Commonwealth's educators to appropriately serve an increasingly diverse population with growing needs. Education finance practices will be faced with the difficulty of not just educating more students, but also addressing the needs of a more diverse student body in the coming years. Coupled with this, however, is the notion that not only will there be a need to address a more diverse student body, but that districts from around the state will have to do so with varying levels of resources due to current discrepancies found between high and low fiscal capacity districts in the Commonwealth (Driscoll & Salmon, 2013).

In the United States, school funding mostly comes from the local government where property taxes are collected in combination with other monies such as lottery funds (Condron, 2017). This causes differing levels of funds to be collected due to variations in wealth that exist across the state. High poverty districts tend to have less revenue per pupil available, which leads to having fewer resources, fewer teachers, and less access to various advanced academic programs (Knight, 2017). As a result, various stakeholders, to include educators and students, have regularly referred to court rulings for solutions to issues of fiscal equity.

Fiscal Litigation

Fiscal equity litigation has been regarded to have occurred in three distinct "waves" (Heise, 1995). Wave one consisted of cases focused on equal protection claims under the United States Constitution, wave two consisted of cases focused on equal protection claims under state constitutions, and wave three consisted of adequacy claims under the education articles of state constitutions (Buszin, 2013). The result of fiscal litigation can be summarized as a reduction in inequity in educational funding from the 1970s to the 1990s, with a rise at the turn of the millennium into what is referred to as the Great Recession (Condron, 2017).

As of 2015, plaintiffs in 46 of the 50 states have challenged the constitutionality of school funding formulas (Taylor, 2015), with the courts ruling in favor of 26 states. California was the first state to win a case challenging funding equity in *Serrano v. Priest* in 1971. *Serrano* cited both the U.S. Constitution and the California constitution arguing that the state's funding formula violated the equal protection clauses of each respective constitution. The courts ultimately found that California's funding formula created "substantial disparities" in school

revenue where the wealth of schools and property were linked (Owings & Kaplan, 2013, p. 67). Therefore, having been found to have discriminated against individuals living in poorer areas, the state was forced to revise its finance formula to eliminate the reliance upon community wealth for providing a quality education (Taylor, 2015).

Another landmark case concerning the constitutionality of funding equity was *San Antonio Independent School District v. Rodriguez* (1973). According to Arbogast (2005), "The U.S. Supreme Court ruled that the Texas funding system did not interfere with a fundamental right" since education is not a right guaranteed by the U.S. Constitution (p. 13). This decision served as a turning point for finance equity litigants because it limited the opportunity for plaintiffs to use the federal Equal Protection clause and shifted focus to the state courts (Owings & Kaplan, 2013).

After *Serrano* (1971) and *Rodriguez* (1973), 22 additional finance cases were brought to the courts. Plaintiffs were victorious in only seven of these 22 cases from 1973-1988 (Brimley, Verstegen & Garfield, 2012). According to Brimley et al. (2012), many believe that the courts feared a snowball effect would occur if state finance systems were found to be unconstitutional. If finance systems were found to be unconstitutional, it would suggest that poverty is what the courts describe as a "suspect classification" (Owings & Kaplan, 2013). A suspect classification is a group of individuals who are treated unfairly for unknown reasons; in other words, such a finding would imply that the impoverished are treated unfairly systematically from a financial perspective. This would be an admission to using discriminatory practices when it comes to educating the country's youth. These cases led into a final wave of litigation that included both equity and adequacy as topics of concern.

A final case foundational to the conversation of financial equity is *Rose v. The Council for Better Education, Inc.* (1989). *Rose* dealt more specifically with the concept of adequacy, which should not be considered entirely apart from the core issue of equity. The Kentucky courts found the state's funding formula to be unconstitutional for failing to provide "the opportunity to develop capabilities in at least seven areas, ranging from sufficient oral and written communication skills to enable students to function in a complex and rapidly changing civilization to sufficient levels of academic or vocational skills…" (*Rose v. The Council for Better Education, Inc*, 1989.). Both affluent and non-affluent districts in the state were found to be underfunding programs and failing to provide adequate opportunities for student growth and

success (Brimley, Verstegen, & Garfield, 2012). While *Rose* paved the way for future court cases and brought awareness to funding disparities across states, further research and analysis of fiscal equity trends among and within states will paint a clearer picture of the degree of fairness in educational funding.

Adequacy and equity are not necessarily synonymous; one concerns outcomes while the other concerns inputs (Springer, 2009). Adequacy in school finance places a strong focus on school outcomes (e.g., performance) while equity is generally concerned about resource inputs (e.g., funding and/or resources). Two studies found consistent results that demonstrated a lessening impact of school finance litigation on funding equity (Condron, 2017; Springer, 2009). Yet, court-mandated equity and adequacy reforms do not yield statistically significant differences in resource distribution (Springer, 2009). Both adequacy and equity claims have been found to decrease horizontal inequities, though adequacy cases decrease inequities at a lesser rate than equity cases (Condron, 2017). Furthermore, Condron (2017) found that inequity in funding was on a steady decline immediately following the adequacy litigation wave that began in 1989. This decline took a turn beginning in 2001, though; more specifically, beginning in 2001, there was a rise in "revenue inequality," essentially undercutting previous gains in equity measures (Condron, 2017).

Fiscal Equity in Virginia

Since 1989, the funding formula in Virginia has remained relatively unchanged (Alexander & Salmon, 2019). The Commonwealth faced litigation over the equity of its financing formula with Scott v. Commonwealth (1994). In Scott, a case was made against the Commonwealth asserting that the Commonwealth had a priority to ensure "substantial equality" in funding allocations. It was found, however, that such a "substantial equality" of payment is not a mandate. Education is a fundamental right, but equitable funding by the commonwealth is not. Districts must only meet the minimum requirements set forth by the Standards of Quality. It was further contended that the Virginia Constitution calls for "an effective system of education throughout the Commonwealth;" students claimed that the existing disparities between the wealthy and poor districts illustrated an ineffective system due to such disparities being present. Further disparities existed between wealthy and poor districts in the following areas: (1) teacher salaries, (2) instructional personnel/pupil ratio, (3) spending for instructional materials, (4) local funding amounts, and (5) the breadth and depth of instructional programs. In each of these five

identified areas, wealthier districts spent more money on students, teachers, and instructional programs. The Courts agreed that funding equity would be ideal, but "simply is not required by the Constitution" (Scott v. Commonwealth, 1994).

Apart from litigation, it is necessary to consider economic factors impacting school funding. The Great Recession affected the country's funding of public education (Knight, 2017). One result from the Great Recession was that school funding budgets were cut across the country. Further comparison of the 2007-2008 school year to the 2012-2013 school year shows that many states were still rebuilding to return to pre-Great Recession equity measures (Leachman, Albares, Masterson, & Wallace, 2016; Salmon, 2010). Yet, Costrell, Hanushek, and Loeb (2008) stated that there is no significance to indicate that more resources lead to more student success; they stated that the important factor is how resources (e.g., money) are spent, not which resources are given. Hanushek's research is widely cited in support of the claim that monetary inputs do not positively impact educational outputs. This claim supports the political stance that governments are needlessly spending more money than ever on education and, yet, seeing less than desirable results (Baker, 2016). The belief that governments are needlessly overinvesting in education fails to consider that as time has progressed, the stakes have continued to grow higher for education. Educators are facing more demanding expectations for student outcomes but are informed that they have to meet these standards with less than what is needed (Baker, 2016). These demands disproportionately affect poorer districts; schools are able to spend more productively on educational supports when they have more funds with which to work. For example, for the 2018-2020 biennium, eight districts in the Commonwealth of Virginia have a reported LCI of 0.8000. Six of the eight districts report that all of their schools are fully accredited (Alexandria reports 87.5% & Fairfax reports 99.5%). Conversely, the eight districts with the lowest LCI between 0.1754 and 0.2189, only two districts report 100% fully accredited schools (School Quality Report, 2018).

Another opposition to Hanushek's research, Card and Krueger (1992a, 1996) further supports how inputs and class sizes have a direct and positive impact on student outcomes and test scores. Their research directly counters Hanushek's findings and explore the long-term effects of increased inputs on student success. They found that increased inputs and smaller class sizes had a correlation with increased student performance and increased future earnings. Card

and Krueger suggest that by improving school resources, students are more likely to achieve success both in the classroom and beyond the classroom.

The question, however, cannot be simplified to whether or not more resources do or do not matter in the subject of student outcomes. It remains that there are inequitable funding practices across low and high poverty districts. These inequities and funding cuts disproportionately affect low income areas, students in poverty, and bilingual students (Baker, 2014; Knight, 2017). Furthermore, recent studies have found that various school finance systems historically become less equitable after a period of recession (Baker, 2014; Evans, Schwab, & Wagner, 2017). The Great Recession specifically impacted high-minority and high-poverty districts, especially in relation to teacher layoffs, in a disproportionate manner (Knight & Strunk, 2016). These teacher layoffs had a further negative impact on these areas of high-poverty due to an increase in teacher churn (i.e., movement within a school year, often within a school) (Goldhaber et al., 2016).

For example, a student who attends a school in a high-poverty district who has substantial budget cuts of about 10% would see long-lasting effects on her academic life. In theory, if those cuts were enacted at the beginning of the student's academic career, those cuts could have a direct impact on the student's overall achievement and even graduation, especially if those cuts were in place for multiple years of the student's schooling (Jackson et al., 2014). Considering this, the cuts districts faced after the Great Recession have had very real and substantial effects on student success for years after the Great Recession officially ended (Knight, 2017).

Further implications exist for educational leaders in the subject of fiscal equity beyond those previously discussed. Salmon (2010) stated that "public [education]… is the most significant cost to local government and one of the largest costs to state government in Virginia" (p. 143). Since the Great Recession of 2007, states across the nation have struggled to meet budgetary needs of districts in an equitable manner, including Virginia whose budget allocated 35.27% of its monies to education (Owings & Kaplan, 2013). This number is down from a pre-recession figure of 36.9% for reporting year 2008, which was the last year of data prior to the recession (Salmon, 2010). Salmon (2010) further stated that there is a level of disproportionality where three major geographical areas (i.e., Hampton Roads, Richmond, and Northern Virginia) have the ability to significantly affect the Local Composite Index (LCI) for the state funding formula with even the slightest fluctuation in wealth. As of 2018, Virginia is ranked 40th in the

nation for state per pupil expenditures, despite falling in the middle for combined state and local per pupil expenditures (Duncombe & Cassidy, 2018). This results in a contrast between districts who have the capacity to pick up the difference and those who do not.

In education, "the goal is to ensure that all districts [across the state] are able to purchase the same amount of real educational resources" (Taylor, 2015, p.249) regardless of the area's level of affluence. According to a recent study, the ability to provide an equitable amount of resources across the entire Commonwealth of Virginia has proven troublesome (Duncombe, 2017). The Commonwealth for Fiscal Analysis reported in 2017 that schools in areas with concentrated poverty have stark contrasts in teacher salaries, course offerings, and spending on instructional materials compared to schools of low poverty (Duncombe, 2017). By definition, a school of high poverty is one where 75 percent or more of the student population qualifies for free or reduced lunch whereas a school of low poverty has 25 percent or less who qualify. Furthermore, "since 2009, staffing in Virginia schools has declined by 1,242 positions while enrollment has grown by more than 50,000 students," which means limited resources and larger class sizes (Duncombe & Cassidy, 2018). Even more, "the high-stakes environment of state-mandated and federally mandated testing… makes resource allocation decisions that enhance the academic performance of students who have historically lagged behind a necessity" (Vesely et al., 2008, pp. 71-72).

In the end, the topic returns to the question of whether or not money matters when it comes to educating students. If the goal is to help students reach their fullest potential, regardless of circumstance and factors outside of their control, then the answer is yes—money matters. The research reviewed supports that per-pupil spending is positively associated with better student outcomes (Baker, 2016). Baker stated, "smaller class sizes, additional supports, early childhood programs, and more competitive teacher compensation… are positively associated with student outcomes" (Baker, p. i, 2016).

Previously, a longitudinal analysis of fiscal equity in the Commonwealth of Virginia was conducted by Arbogast (2005). In the study, Arbogast conducted an historical analysis of fiscal equity in the Commonwealth of Virginia from 1974-2003. This analysis measured fiscal equity from the iteration of the standards of quality in the Commonwealth of Virginia in 1974 through the year of 2003. In his analysis, Arbogast measured fiscal equity through the following methods: range, restricted range, restricted range ratio, federal range ratio, coefficient of

variation, the Gini Coefficient, the McLoone Index, the Theil Index, the Pearson correlation, regression, slope, and elasticity. Through his analysis, Arbogast concluded that over the course of the study, fiscal equity had increased in the Commonwealth of Virginia.

Measuring Fiscal Equity

The chosen measures of horizontal and vertical equity for this study are range, restricted range, restricted range ratio, coefficient of variation, the Theil Index, the Pearson Correlation, regression, slope, elasticity, the Gini Coefficient, and the McLoone Index. Multiple measures of equity were used at the recommendation of Berne and Stiefel (1984) and Picus and Odden (2004). Each equity measure is further explained in chapter three.

Summary of Literature Review

This chapter reviewed historical perspectives, summarized the national waves of school finance litigation, reviewed school finance litigation in Virginia, reviewed the methods for funding Virginia's schools, and discussed methods for measuring horizontal and vertical fiscal equity. The methods for funding K-12 schools in the Commonwealth of Virginia are not without scrutiny. Researchers (Salmon, 2010; Salmon & Alexander, 2019) suggest that the LCI is an imperfect measure of fiscal capacity due to its reliance upon dated data and its cap at 0.8000 which ensures divisions with higher fiscal capacity still receive funds from the state. Furthermore, data supports a greater fiscal capacity than actual effort provided by the Commonwealth of Virginia (BEA, 2019). The question still remains as to whether or not the funding system in the Commonwealth of Virginia has achieved horizontal or vertical fiscal equity despite such criticisms. From the literature reviewed, it is evident that fiscal equity is a complex topic that has remained and will remain a subject concern through the years.

Chapter 3
Methodology

Purpose

The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. The research questions central to the study are the following:

Research Question 1: How has the horizontal equity of school funding changed in the Commonwealth of Virginia since 2004?

Research Question 2: How has the vertical equity of school funding changed in the Commonwealth of Virginia since 2004?

Research Design and Justification

This study is a quantitative longitudinal study of fiscal equity over the course of fourteen years in the Commonwealth of Virginia from 2004-2018. This study utilizes multiple equity statistical measures, descriptive statistics, and wealth neutrality statistical measures using fiscal data from predetermined dates. Use of multiple statistical measures and data points at fixed intervals to represent the second year in each biennium allowed for clearer interpretation of data. At fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018, data points were drawn and analyzed for each of the 132 reporting divisions across the Commonwealth of Virginia. This information was found on the Virginia Department of Education website in the Superintendent's Tables 15 and 16 of each respective year analyzed. Information reported in these tables includes the adjusted per pupil expenditures (local and state funds minus federal funds) and the local composite index (LCI) for each division (VDOE, 2020).

Range, restricted range, restricted range ratio, coefficient of variation, the Theil Index, the Pearson Correlation, regression, slope, elasticity, the Gini Coefficient, and the McLoone Index were used to measure horizontal and vertical equity. Horizontal equity is best understood to be the equal treatment of unequals. This concept assumes that each division would allocate equal per pupil funding, thus making each district mathematically identical. It does not take into account the varying needs of students and their varying costs of education (e.g., economically disadvantaged students, special education students, and English language learners) (Berne & Stiefel, 1984; Glenn et al., 2009). Vertical equity is best understood as how well a district meets

the unique needs of its students; it takes into account the differing costs for educating various groups. For the purposes of this study, weights were applied to identified student groups before conducting horizontal equity analyses to measure the vertical equity of a system.

The most commonly used measures of horizontal equity, range, restricted range, coefficient of variation, the McLoone index, are outlined in the work of Berne and Steifel (1984). Additionally, Odden and Picus (2004) identified range, federal range, coefficient of variation, Gini Coefficient, and the McLoone Index as optimal measures of fiscal equity. This study adopted a combination of measures suggested in the works of Berne and Steifel (1984) and Odden and Picus (2004). Additionally, this study applied weights to student counts in these identified measures to account for vertical equity.

The researcher was trained in human subjects protection and acquired certification from the Virginia Tech institutional review board (IRB). It was determined that the study did not require human subjects. These documents can be found in Appendices A and B.

Explanation of Descriptive Statistics and Interpretation

Mean: the average of total adjusted expenditures and total pupils.

$$\frac{\text{Total Adjusted Expenditures}}{\text{Total Pupils}}$$

For the purposes of this study, the total amount of adjusted expenditures per division will be analyzed for each selected year in relation to the total pupils per division as well as the mean for the entire Commonwealth of Virginia. The mean adjusted per-pupil expenditures for each division will be represented as X_i. The mean adjusted per-pupil expenditures for the Commonwealth of Virginia will be represented as X_p. The mean will be calculated for both unweighted adjusted per pupil expenditures and unweighted adjusted per pupil expenditures using the methods outlined above.

Median: a value lying at the midpoint of a data set where there is an equal chance of a value falling either below or above that point. In this study, the median adjusted per-pupil expenditures for the Commonwealth will be represented as M_p. For this study, the median is an integral measure for calculating the McLoone Index. This measure is also represented both in an unweighted and weighted value to account for both horizontal and vertical equity.

Explanation of Equity Statistics and Interpretation

Range: The range is measured by examining the difference between the highest and the lowest total expenditures (x_i) per pupil across divisions in the Commonwealth.

$$\text{Highest } x_i\text{-Lowest } x_i$$

Using this measure is simple and easy to explain yet is limiting in the information it presents due to its tendency to place increased focus on extremes. This measure should not be examined in isolation when considering equity measures. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As range decreases, both horizontal and vertical equity increase.

Restricted Range: Restricted range is the difference between total adjusted per pupil expenditures (x_i) at the 95th and the 5th percentiles.

$$x_i \text{ at or above which 5\% of total pupils lie}$$
$$- x_i \text{ at or below which 5\% of total pupils lie}$$

This measure is similar to range, but it ignores the extreme ends of the given distribution of data. Still, the restricted range does not provide a statistic for the entire distribution. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the restricted range decreases, both horizontal and vertical equity increase.

Restricted Range Ratio: The restricted range ratio is calculated by dividing total adjusted per pupil expenditures (x_i) at 5th percentile and dividing it by those at the 95th percentile.

$$\left(\frac{x_i \text{ at or below which 5\% of total pupils lie}}{x_i \text{ at or above which 5\% of total pupils lie}}\right)$$

This number is presented in a ratio rather than in a dollar amount. As with the range and the restricted range, the restricted range ratio is calculated with a focus on the extremes and fails to provide information about the entire distribution of data. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the restricted range ratio decreases, both horizontal and vertical equity increase.

Coefficient of Variation (CV): The coefficient of variation (CV) is measured by taking the standard deviation of a distribution of total adjusted per pupil expenditures and dividing it by the mean of the data set. This number is represented as a percentage.

$$\frac{\sqrt{\frac{\sum_{i=1}^{N}\left(\bar{x}_p - x_i\right)^2}{\sum_{i=1}^{N} P_i}}}{\bar{X}_p}$$

For the purposes of this study, N represents the total number of reporting divisions in the Commonwealth, X_i represents the mean per-pupil expenditures in the division, X_p represents the mean per-pupil expenditures for all pupils across the Commonwealth, and P_i represents the number of students in the division. Unlike the ratio, restricted range, and the restricted range ratio, the CV measures the variability of the entire distribution of per-pupil expenditures. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the CV increases, both horizontal and vertical equity decrease.

Theil Index: The Theil Index is a measure of the variation of adjusted per pupil expenditures across the entire distribution.

$$\frac{\left(\sum_{i=1}^{N} P_i \left(X_i \log_e X_i - \bar{X}_p \log_e \bar{X}_p\right)\right)}{\left(\bar{X}_p \sum_{i=1}^{N} P_i\right)}$$

For the purposes of this study, N represents the total number of reporting divisions in the Commonwealth, X_i represents the mean adjusted per pupil expenditures in the division, X_p represents the mean adjusted per pupil expenditures for all pupils across the Commonwealth, and P_i represents the number of students in the division. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. The Theil Index can range from 0.0 to 1.0. As the Theil Index decreases, both horizontal and vertical equity increase.

The Lorenz Curve and Gini Coefficient: Alexander, Salmon, & Alexander (2015) explained that the Lorenz Curve is developed by "plotting data for cumulative proportions of pupils and cumulative proportions of per-pupil inputs on coordinate axes" (p. 360). These data points are then sorted by per-pupil expenditures. If equal, the adjusted per pupil expenditures would form a 45-degree line. The Gini Coefficient is known as the area under the plotted line and the curve.

$$\left(\frac{\sum_{i=1}^{N}\sum_{j=1}^{N} P_i\, P_j \left|X_i - X_j\right|}{\left[2\left(\sum_{i=1}^{N} P_i\right)^2 \overline{X_p}\right]}\right)$$

For the purposes of this study, N represents the total number of reporting divisions in the Commonwealth, X_i represents the mean adjusted per pupil expenditures in the division, X_p represents the mean adjusted per pupil expenditures for all pupils across the Commonwealth, and P_i represents the number of students in the division.

Expressed as a fraction, the Gini Coefficient will vary from 0.0 to 1.0. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. Equity increases as the Gini Coefficient decreases. A Gini Coefficient of 0.0 would assume absolute equity.

McLoone Index: While the McLoone Index is an equity measure for the entire distribution of a data set, it provides a ratio for the lower half of a distribution of adjusted per pupil expenditures in relation to the entire data set. It is the representation of the total adjusted expenditures relative to the inputs those at the lower half would receive if they were at the median adjusted per pupil expenditure level.

$$\frac{\left(\sum_{i=1}^{J} P_i X_i\right)}{\left(M_p \sum_{i=1}^{N} P_i\right)}$$

For the purposes of this study, N represents the total number of reporting divisions in the Commonwealth, X_i represents the mean adjusted per pupil expenditures in the division, X_p represents the mean adjusted per pupil expenditures for all pupils across the Commonwealth, P_i represents the number of

students in the division, and M_p represents the median adjusted per pupil expenditures in the Commonwealth.

This measure, while it provides insight on the equity of the lower half's adjusted per pupil expenditures, it ignores the other half of the distribution. It performs with the assumption that horizontal and vertical equity are only necessary up to the median adjusted per pupil expenditure amount. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. The McLoone Index can range from 0.0 to 1.0. As the McLoone Index increases, both horizontal and vertical equity for the lower half of the distribution increase.

Explanation of Wealth Neutrality Statistics and Interpretation

Pearson Correlation: The Pearson Correlation is a measure of adjusted per pupil expenditures in relation to a locality's fiscal capacity or ability to pay. This measure can vary from 0.0 to ≥ 1.0 with 0.0 representing no relationship between fiscal capacity and adjusted per pupil expenditures. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the correlation between adjusted per pupil inputs and fiscal capacity decreases, equity and fiscal neutrality increase.

Regression: Regression is a measure used to determine the percent of a variation between fiscal capacity and adjusted per pupil expenditures of a locality. This percentage may range from 0.0 to 100.0. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the regression percentage decreases, both equity and fiscal neutrality increase.

Slope: The slope represents the size of a change in the adjusted per pupil expenditures in relation to the fiscal capacity of the district in absolute terms. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the slope decreases, both equity and fiscal neutrality increase.

Elasticity: Similar to the slope, the elasticity measures the size of a change in the per-pupil expenditures in relation to the fiscal capacity of a district, but in a percentage rather than in absolute terms. For this study, this measure is represented both in an unweighted and weighted value to account for both horizontal and vertical equity. As the elasticity decreases, both equity and fiscal neutrality increase.

Methods Used to Account for Vertical Equity

When calculating the range, restricted range, restricted range ratio, coefficient of variation, Theil Index, Pearson Correlation, regression, slope, elasticity, Gini Coefficient, and McLoone Index, applied weights were utilized in order to mathematically account for the varying costs of different classifications of students. Applied weights were utilized to account for three specific groups of students who traditionally require additional funding when compared to the majority of the student population: student with disabilities (SWD), economically disadvantaged students (EDS), and English language learners (ELL) (Berne & Stiefel, 1984). Table 1 illustrates the applied weights that were utilized for each group identified when calculating vertical equity for FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018:

Table 1

Breakdown of Applied Student Weights for Vertical Equity Measures

Student Categorization	Applied Categorical Weight
Standard Student	1.0
Student with Disabilities (SWD)	2.27
Economically Disadvantaged Student (EDS)	1.15
English Language Learner (ELL)	<15 in division, 1.7 16-250 in division, 1.525 ≥ 251- 1.5

Information identifying the number of students for each of the listed categories can be found on the Virginia Department of Education website (VDOE, 2020).

Measures Used to Measure Uncapped LCI

The researcher used a true measure of fiscal capacity for divisions with a capped LCI of 0.8000. Divisions falling into this category vary across the reporting years of this study, but such

measures have direct impact on the efficacy of the study if left uncapped. In order to measure the uncapped LCI, the researcher used information from Table 15 from the VDOE website. The researcher calculated a percent representing a comparison of per pupil and per person totals in the Commonwealth of Virginia for each year analyzed. Then, the comparisons were multiplied according to the Commonwealth's funding formula to represent an uncapped LCI. The following measures were used to calculate the uncapped LCI for divisions across the Commonwealth of Virginia for this study:

Property Per Pupil Comparison

$$\frac{\frac{Division\ True\ Property\ Value}{Division\ ADM}}{\frac{State\ Total\ Property\ Value}{State\ Total\ ADM}}$$

Adjusted Gross Income Per Pupil Comparison

$$\frac{\frac{Division\ AGI}{Division\ ADM}}{\frac{State\ Total\ AGI}{State\ Total\ AGI}}$$

Sales per Pupil Comparison

$$\frac{\frac{Division\ Taxable\ Retail\ Sales}{Division\ ADM}}{\frac{State\ Total\ Taxable\ Retail\ Sales}{State\ Total\ ADM}}$$

Property Per Person Comparison

$$\frac{\frac{Division\ True\ Property\ Value}{Division\ Total\ Population}}{\frac{State\ Total\ True\ Property\ Value}{State\ Total\ Population}}$$

Adjusted Gross Income Per Person Comparison

$$\frac{\frac{Division\ AGI}{Division\ Total\ Population}}{\frac{State\ Total\ AGI}{State\ Total\ Population}}$$

Sales Per Person Comparison

$$\frac{\frac{Division\ Taxable\ Retail\ Sales}{Division\ Total\ Population}}{\frac{State\ Taxable\ Retail\ Sales}{State\ Total\ Population}}$$

Per Pupil Total

The researcher applied the previous measures to the following formula in order to calculate a new, uncapped LCI. The percentages utilized reflect the measures utilized by the Commonwealth when calculating the LCI for divisions biannually. These measures were applied to pupil and person totals for the reporting divisions and the Commonwealth respectively.

$$0.50\ x\ Property\ Per\ Pupil\ Comparison + 0.40\ x\ AGI\ Per\ Pupil\ Comparison + 0.10\ x\ Sales\ Per\ Pupil\ Comparison$$

Per Person Total

The researcher applied the previous measures to the following formula in order to calculate a new, uncapped LCI. The percentages utilized reflect the same measures used by the Commonwealth to calculate LCI for divisions biannually. These measures were applied to population totals for the reporting divisions and the Commonwealth respectively.

$$0.50\ x\ Property\ Per\ Person\ Comparison + 0.40\ x\ AGI\ Per\ Person\ Comparison + 0.10\ x\ Sales\ Per\ Person\ Comparison$$

Uncapped LCI

The researcher applied the results from the per pupil total and per person totals in order to calculate an uncapped LCI for each division in the Commonwealth measuring 0.8000. The methodology utilized to calculate this measure is the same as is utilized by the Commonwealth when calculating LCI.

$$0.45\ x\ (0.6777)\ x\ Per\ Pupil\ Total + 0.333\ x\ Per\ Person\ Total$$

Data were not available for measuring the uncapped LCI for divisions during FY2004. For this study, FY2004 will use the capped LCI. Each division using an uncapped LCI for FY2006, FY2008, FY2010, FY2012, FY2014, FY2016, and FY2018, along with the adjusted LCI measure computed, is represented in Table 2.

Table 2

Divisions' Uncapped LCI Measures Across Reporting Years for the Study

2004		2006		2008		2010	
Data were not available for measuring the uncapped LCI for divisions during FY2004.		Division	Uncapped LCI	Division	Uncapped LCI	Division	Uncapped LCI
		Alexandria	1.2018	Alexandria	1.2738	Alexandria	1.3218
		Arlington	1.2086	Arlington	1.2615	Arlington	1.2404
		Bath	1.4560	Bath	1.2649	Bath	1.0397
		Fairfax	1.4015	Fairfax	0.9690	Fairfax	0.9143
		Falls Church	1.9003	Falls Church	0.8758	Falls Church	0.8841
		Goochland	09368	Goochland	0.8928	Goochland	0.91695
		Surry	0.8819	Williamsburg/ James City	1.1714	Rappahannock	0.87407
		Williamsburg/ James City	1.2247				
2012		2014		2016		2018	
Division	Uncapped LCI	Division	Uncapped LCI	Division	Uncapped LCI	Division	Uncapped LCI
Alexandria	1.2345	Alexandria	1.2344	Alexandria	1.1818	Alexandria	1.1347
Arlington	1.1979	Arlington	1.2637	Arlington	1.2293	Arlington	1.2564
Bath	1.0909	Bath	1.1144	Bath	1.146	Bath	0.8513
Fairfax	0.8338	Fairfax	0.8007	Falls Church	0.8622	Falls Church	0.8513
Falls Church	0.8591	Falls Church	0.8455	Goochland	0.9414	Goochland	0.9042
Goochland	1.0698	Highland	0.9032	Highland	1.0383	Highland	0.9362
Lancaster	0.8892	Goochland	0.9427	Surry	0.8655	Surry	0.8577
Northumberland	0.8389	Northumberland	0.8218				
Rappahannock	0.8153	Rappahannock	0.8307				
Williamsburg/ James City	0.8330						

Data Collection and Analysis Procedures

A database has been established of all reporting K-12 divisions in the Commonwealth of Virginia. Information was collected from the National Education Association (NEA), the Virginia Department of Education (VDOE), the Commonwealth Institute, and published Joint Legislative Audit and Review Commission (JLARC) reports. Expenditure information for each district in the Commonwealth during pre-determined fiscal years was collected to include federal, local, state, and sales tax amounts. Federal funds were subtracted from expenditure data to focus solely on local and state expenditures. Data was drawn from FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018 and stored in Microsoft Excel spreadsheets prior to analysis. Fiscal year 2004 was selected to serve as a baseline to follow the study previously conducted by Arbogast, which concluded in 2003. Additional dates were selected as fixed points to both reflect the final year of each biennium, which is when the LCI is recalculated and to consistently cover the a fourteen-year period of the study. Microsoft Excel was used to support statistical analyses and graphical representations of data from the study.

Summary

This chapter reviewed the purpose of the study, the research questions, and the utilized statistical measures for conducting this longitudinal fiscal equity analysis of the Commonwealth of Virginia from FY2004 to FY2018. The research design included an explanation of each of the statistical measures and provided an explanation of how to interpret findings from those measures. Finally, the chapter outlined how the data was collected, for which years the data was selected, and how the data was stored prior to analysis. The next chapter presents the findings of the various statistical measures of the study.

Chapter 4
Presentation and Analysis of Data

Introduction

The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. In order to complete this study, the researcher selected the second year in each biennium from FY2004 to FY2018, which included the following: FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018. Enrollment, fiscal, and population data were analyzed to determine the horizontal equity of per pupil expenditures for the 132 reporting divisions in the Commonwealth of Virginia for the selected fiscal years. The same data were analyzed to measure vertical equity with weights applied to enrollment figures to adjust for a truer cost of educating identified classifications of students within each division's enrollment. The following statistical measures were utilized in the study to both inform and measure horizontal and vertical equity: mean, median, range, restricted range, restricted range ratio, coefficient of variation, regression, slope, elasticity, the Theil Index, the Pearson correlation, the Gini Coefficient, and the McLoone Index.

Descriptive, Wealth Neutrality, and Equity Statistics

The first section of this chapter reports the findings of various descriptive, wealth neutrality, and equity statistics to include the following: mean, median, range, restricted range, restricted range ratio, coefficient of variation, regression, slope, elasticity, and the Theil Index. Both weighted and unweighted measures are reported for each selected fiscal year to account for both horizontal and vertical equity. For each of these statistical measures, specific data selected from the Virginia Department of Education included the adjusted per pupil expenditures for each division in the Commonwealth and the measure of fiscal capacity (i.e., the local composite index or LCI). For select divisions, the uncapped measure of fiscal capacity was used to ensure a more accurate measure of fiscal capacity in relation to the adjusted per pupil expenditures. The findings from these identified statistical measures are represented in Table 3 and Figures 4-15.

Table 3

Unweighted and Weighted Descriptive Statistics Findings FY 2004-2018

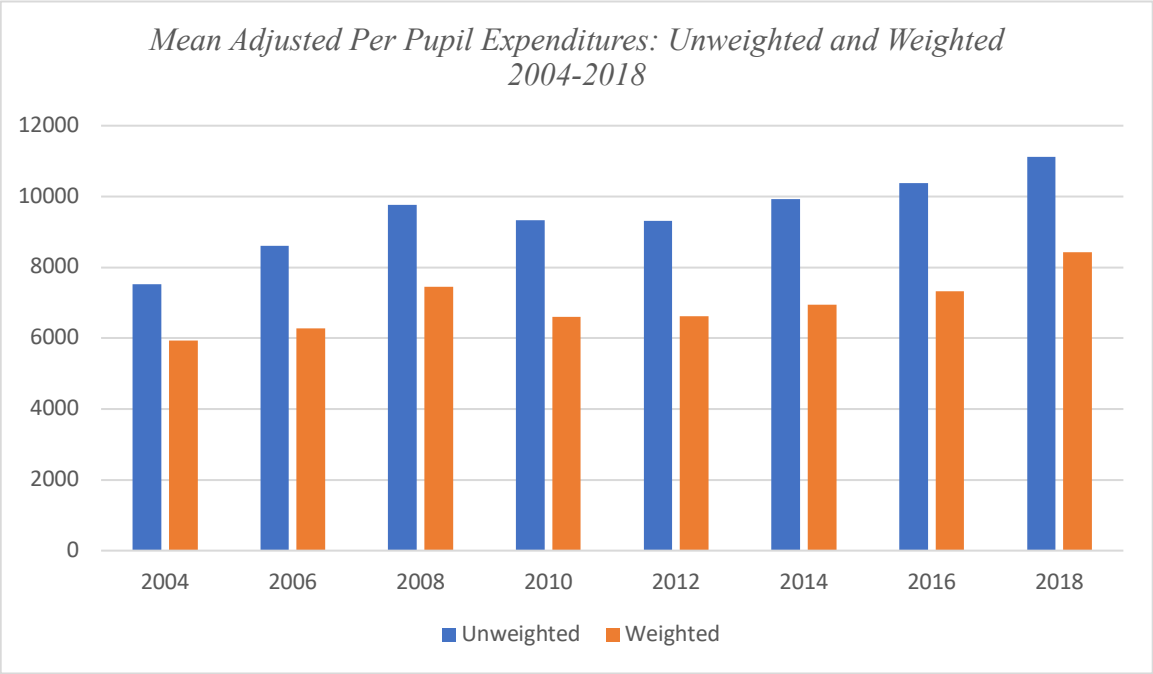
	2004	2006	2008	2010	2012	2014	2016	2018
Mean PPE	7,520	8,611	9,763	9,331	9,306	9,927	10,388	11,127
W. Mean PPE	5,937	6,269	7,458	6,595	6,623	6,943	7,329	8,423
Mean LCI	0.389	0.415	0.403	0.396	0.407	0.410	0.407	0.397
Median PPE	7,216	8,325	9,511	9,262	9,158	9,794	10,196	10,918
W. Median PPE	5,816	6,393	7,482	6,683	6,872	6,947	7,223	8,075
CV	0.193	0.203	0.199	0.202	0.202	0.194	0.196	0.195
W. CV	0.183	0.201	0.193	0.207	0.209	0.197	0.209	0.191
Range of PPE	9,243	10,522	11,865	11,622	10,900	11,147	10,924	11,724
W. Range of PPE	6,456	8,801	9,229	9,477	8,300	8,346	9,732	9,374
Rest. Range PPE	3,982	4,506	4,891	4,276	4,919	3,733	5,115	5,328
W. Rest. Range	3,586	4,899	4,665	4,329	4,145	4,041	4,383	4,382
Rest. Range Ratio	0.628	0.621	0.596	0.546	0.635	0.381	0.589	0.569
W. Rest. Range Ratio	0.726	0.925	0.740	0.794	0.759	0.704	0.721	0.615
Pearson (PPE to LCI)	0.690	0.736	0.706	0.707	0.704	0.775	0.793	0.803
W. Pearson (PPE - LCI)	0.690	0.784	0.732	0.739	0.711	0.750	0.769	0.801
r^2 (PPE, LCI)	0.473	0.540	0.512	0.506	0.495	0.601	0.630	0.644
W. r^2 (PPE, LCI)	0.452	0.614	0.533	0.544	0.505	0.563	0.592	0.641
Adj. r^2 (PPE, LCI)	0.469	0.537	0.509	0.502	0.492	0.598	0.627	0.642
W. Adj. r^2 (PPE, LCI)	0.448	0.611	0.530	0.540	0.501	0.560	0.589	0.638
Slope (PPE, LCI)	6,853	5,031	6,632	6,421	6,439	7,571	8,201	9,388
W. Slope (PPE, LCI)	4,969	3,871	5,103	4,878	4,776	5,198	5,982	6,954
Theil	0.0346	0.0336	0.0356	0.0321	0.0383	0.0333	0.0343	0.0306
W. Theil	0.0276	0.0367	0.0366	0.0446	0.0470	0.0452	0.0453	0.0320
Elasticity	0.3550	0.2425	0.2739	0.2725	0.2814	0.3126	0.3209	0.3350
W. Elasticity	0.326	0.256	0.276	0.293	0.293	0.307	0.332	0.328

On the following pages in this chapter, a more in-depth analysis of findings is explained for the findings reported in Table 3.

Figure 4 reflects the unweighted and weighted mean adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 4

Mean Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018



Multiple measurements of mean have been calculated for this study: the unweighted and weighted mean adjusted per pupil expenditures and the mean local compositive index (LCI) for the Commonwealth. While the mean does not measure equity, it is necessary to calculate for the purposes of other equity statistics. These measures are worth making note of, however, as they help provide a fuller picture of the operations and expenditures of divisions for the fiscal years measured. Mean is the average of the adjusted per pupil expenditures; a mean for both unweighted and weighted adjusted per pupil expenditures has been taken to account for both vertical and horizontal equity measures.

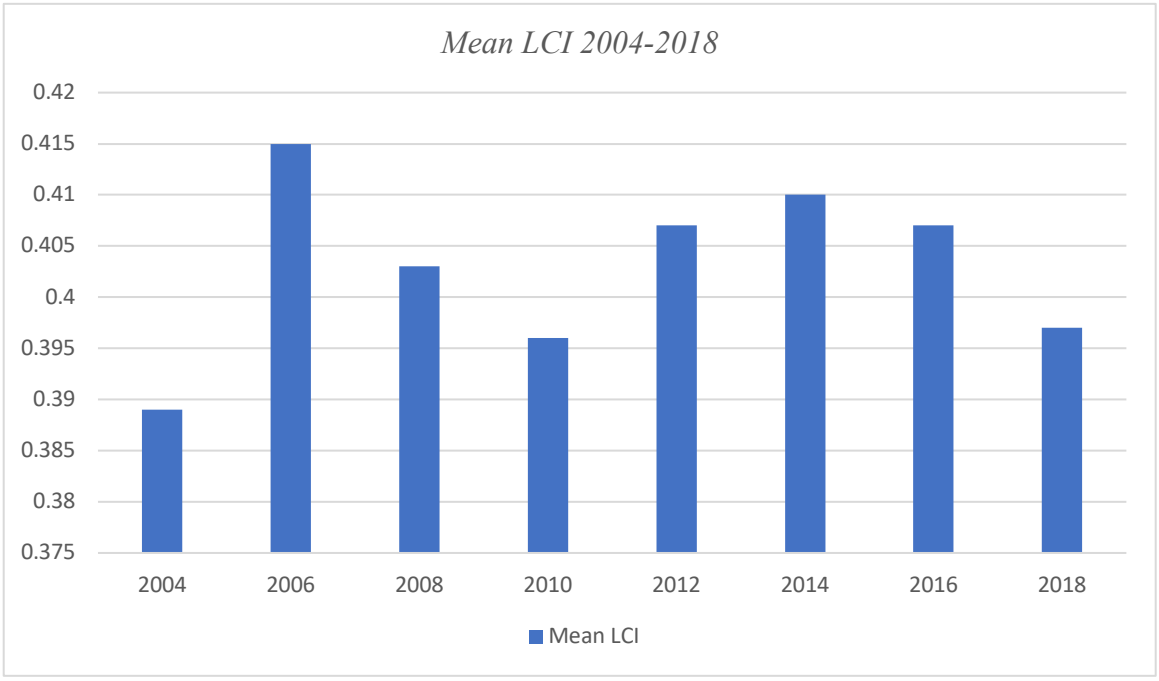
The unweighted mean adjusted per pupil expenditures for the years of this study, as represented in Figure 4, suggests that divisions are contributing more funds per pupil. The only exception to this in the study resulted between FY2010 to FY2012, where the unweighted adjusted per pupil expenditures dropped $25. Then, the unweighted adjusted per pupil expenditures increased from FY2012 to FY2014 by $621. Overall, the difference in the mean unweighted adjusted per pupil expenditures during the measured fiscal years reflected an increase of $3,607. This result should not be considered in isolation, however, as it can be adversely impacted by extreme values.

The weighted mean adjusted per pupil expenditures for the years of this study, as represented in Figure 4, suggests that divisions are contributing more funds per pupil across the years of the study, but fewer funds with weights applied. From FY2004 to FY2008, there was an increase in weighted adjusted per pupil expenditures of $1,521. Yet, when compared to the unweighted years, FY2008 reflected $2,305 fewer adjusted per pupil expenditures. From FY2008 to FY2010, there was a decrease in weighted adjusted per pupil expenditures of $863. Then, from FY2010 to FY2018, an increase of $1,800 in weighted adjusted per pupil expenditures. However, when compared to the unweighted adjusted per pupil expenditures in FY2018, there is a difference of $2,704, suggesting that when weights are applied, divisions in the Commonwealth are, on average, spending fewer dollars per pupil. This does not paint a full enough picture of equity, however, when read in isolation; instead, this measure serves as an informative figure for other equity statistics utilized in the study.

Figure 5 reflects the unweighted and weighted mean LCI for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 5

Mean LCI 2004-2018



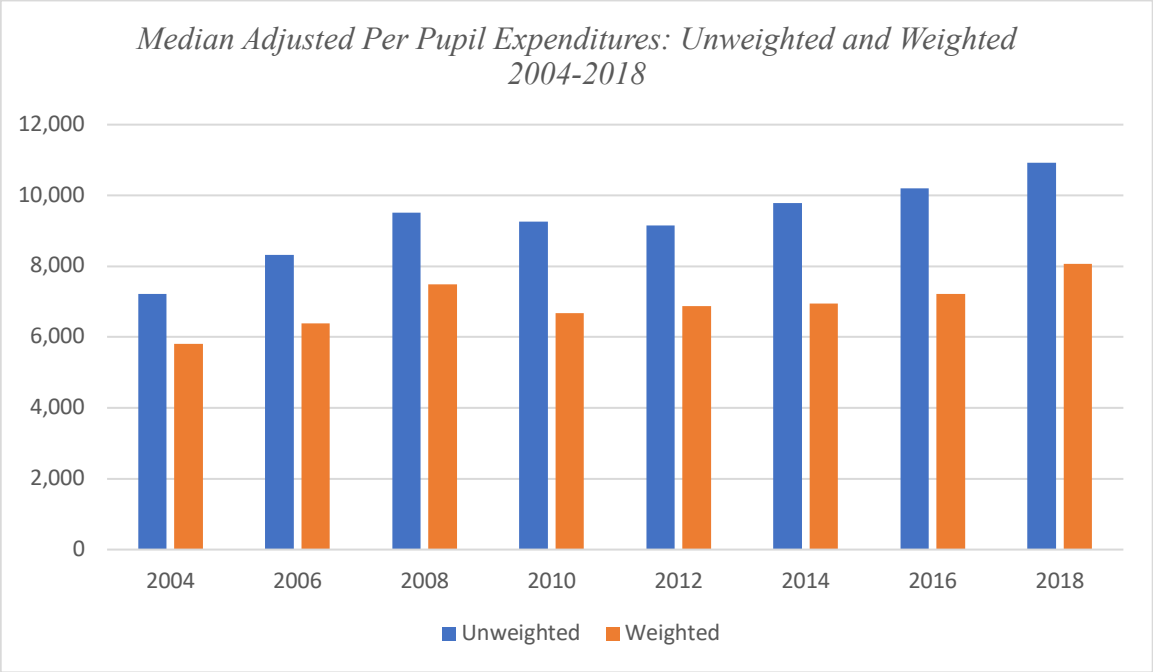
The mean LCI across the Commonwealth, however, reflected more fluctuations than the mean adjusted per pupil expenditures. While there was an increase of 0.026 between FY2004

and FY2006, there was a 0.012 decrease in mean LCI between FY2006 and FY2008 and a subsequent 0.007 decrease between FY2008 and FY2010. Between FY2010 and FY2012, there was an increase of 0.011, and another 0.003 increase between FY2012 and FY2014. The final two fiscal years of the study reflected another decrease in LCI. Between FY2014 and FY2016, there was a decrease of 0.003 and another decrease of 0.01 between FY2016 and FY2018. Overall, the difference in the mean LCI for the divisions during the measured fiscal years reflected an increase of 0.008. While the mean LCI reflected slight fluctuations across the fiscal years measured, the overall change remained fairly constant. Much like the mean adjusted per pupil expenditures, however, the mean LCI should not be considered a measure of equity in isolation; it is utilized as an independent variable to inform equity statistics in statistical analysis.

Figure 6 reflects the unweighted and weighted median adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 6

Median Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018



The median is the midpoint of a data set under which 50% of the data lies. The median is another variable utilized to inform other equity statistics, such as the McLoone Index. While the median does provide insight to the condition of school funding for a particular fiscal year, it does not provide enough information to analyze the degree of equity for the Commonwealth. For each

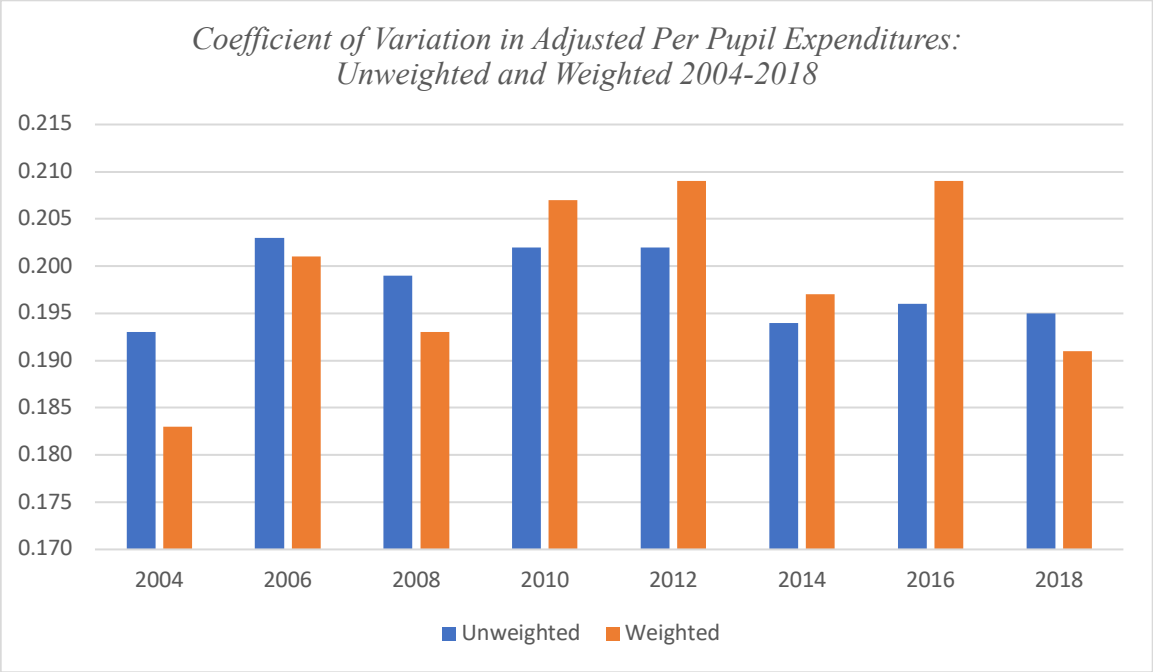
year of the study, the unweighted median adjusted per pupil expenditures was greater in dollar amounts than the weighted median. The division number of the median was also higher for the unweighted count when compared to the weighted count in every year except FY2018.

In FY2004, the unweighted median adjusted per pupil expenditures was $7,216 where 73 divisions fell below the median and the weighted median adjusted per pupil expenditures was $5,816 where 75 division fell below the median. Both amounts increased in FY2006 and FY2008. In FY2010, the unweighted median adjusted per pupil expenditures was $9,262 where 89 divisions fell below the median and the weighted median adjusted per pupil expenditures was $6,683 where 92 division fell below the median. From FY2010 to FY2012, the unweighted median adjusted per pupil expenditures dropped $104 where 86 divisions fell below the median, but the weighted median adjusted per pupil expenditure increased $189 where 93 divisions fell below the median. For the remaining fiscal years measured, both the unweighted and weighted adjusted per pupil expenditures increased. In FY2018, the unweighted median adjusted per pupil expenditures was $10,918 where 82 divisions fell below the median and the weighted median adjusted per pupil expenditures was $8,075 where 74 divisions fell below the median.

Figure 7 reflects the unweighted and weighted coefficient of variation in adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 7

Coefficient of Variation in Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018

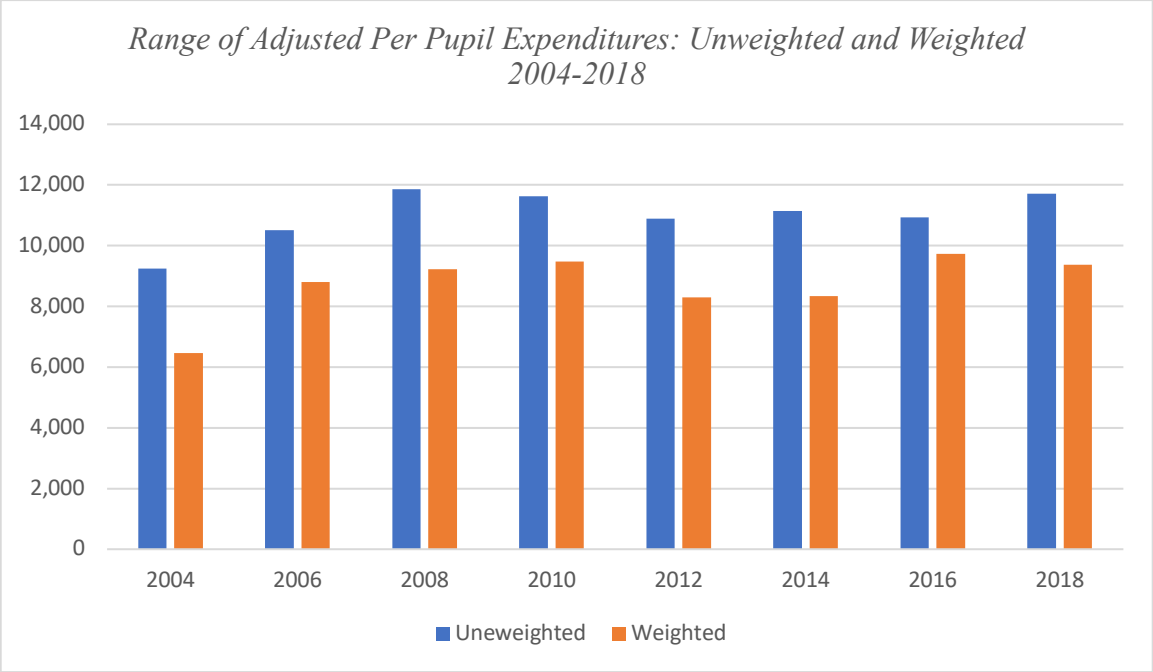


The coefficient of variation (CV) is measured by taking the standard deviation of a distribution of total adjusted per pupil expenditures and dividing it by the mean of the data set. This is represented in a percentage. As the CV increases, both the horizontal and vertical equity decrease. For the duration of the study, the CV had several fluctuations. From FY2004 to FY2006, both the unweighted and weighted CV values increased, thus reflected a decrease in horizontal and vertical equity. In FY2008, the unweighted and weighted CV both decreased from 0.203 to 0.199 and from 0.201 to 0.193 respectively, reflecting an increase in fiscal equity during the biennial. Between FY2008 and FY2014, there are several fluctuations in CV values to increase both increased and decreased equity. In FY2014, the unweighted CV was 0.195 and the weighted CV was 0.191. When considering the length of the study, FY2004 reflected a lower CV for both unweighted and weighted values than FY2018, thus reflecting an overall decrease in both horizontal and vertical equity over the course of the measured years.

Figure 8 reflects the unweighted and weighted range of adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 8

Range of Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018

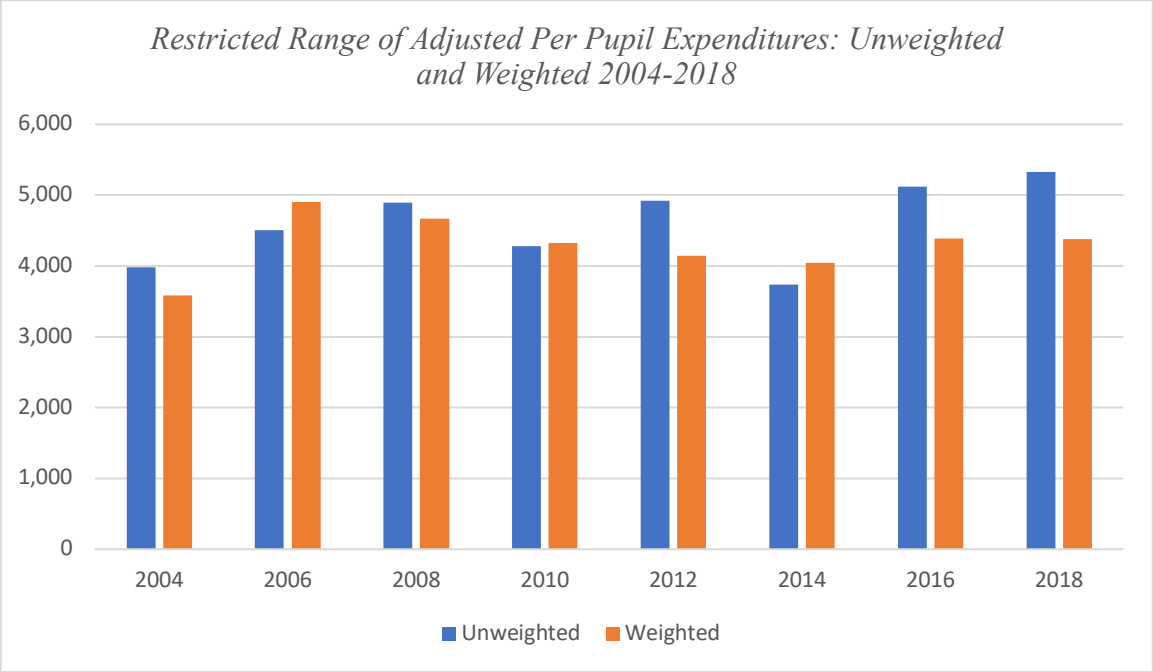


The range is measured by determining the difference between the highest and the lowest adjusted per pupil expenditures. To account for both vertical and horizontal equity, both the unweighted and weighted ranges were measured. The range of the unweighted and weighted adjusted per pupil expenditures both fluctuated between FY2004 and FY2018. At its highest, the range of the unweighted adjusted per pupil expenditures was $11,865 in FY2008 and the weighted was in FY2016. The range was at its lowest for both the unweighted and weighted adjusted per pupil expenditures in FY2004 measuring $9,243 and $6,456 respectively. Over the course of the fiscal years measured, there was an overall increase in both unweighted and weighted range. Between FY2004 and FY2018, the range of the unweighted adjusted per pupil expenditures increased $2,481and the range of the weighted adjusted per pupil expenditures increased $2,918. While the range should not be considered in isolation as a true measure of equity, the increase in the measure suggests a decrease in both horizontal and vertical equity.

Figure 9 reflects the unweighted and weighted restricted range of adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 9

Restricted Range of Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018

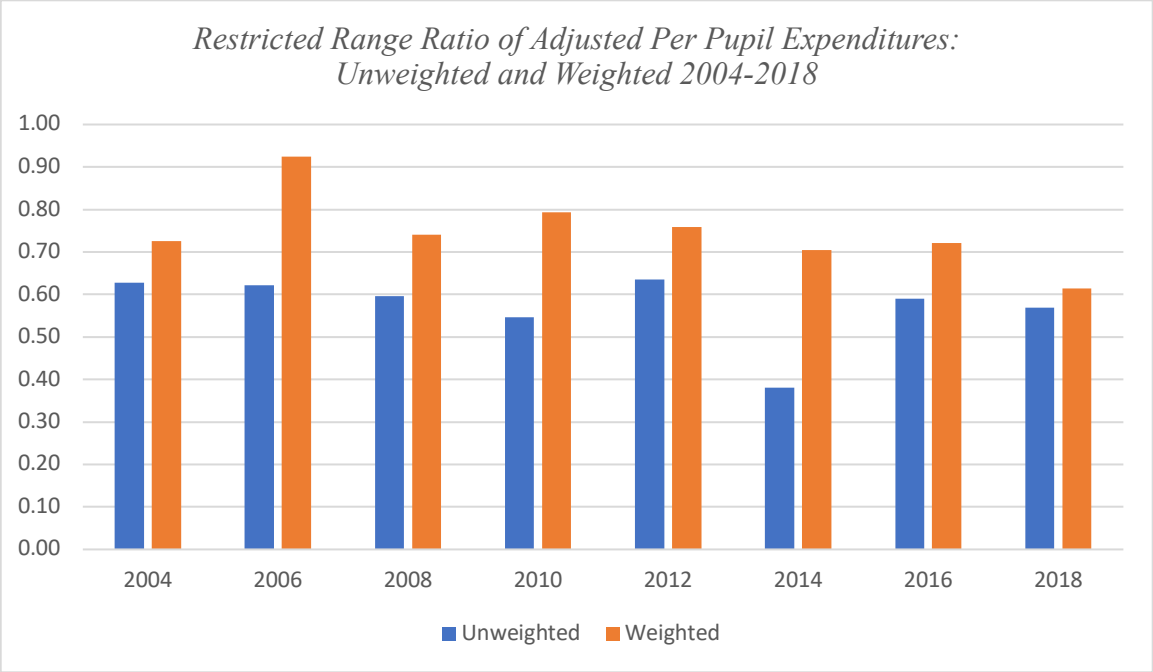


The restricted range is the difference between the total adjusted per pupil expenditures at the top 5% of a data set and the bottom 5% of a data set. By excluding the top and bottom 5%, this measure removes extreme values within a distribution of data. Over the course of the measured fiscal years, the restricted range reflected similar results to that of the range where the values fluctuated across the years. However, when removing the extreme ends of the distribution set, only FY2006, FY2010, and FY2014 reflected a greater restricted range with the weighted values than the unweighted. Between FY2004 and FY2018, the restricted range of the unweighted adjusted per pupil expenditures increased $1,346 and the restricted range of the weighted adjusted per pupil expenditures increased $796. While the restricted range should not be considered in isolation as a true measure of equity, the increase in the measure suggests a decrease in both horizontal and vertical equity.

Figure 10 reflects the unweighted and weighted restricted range ratio of adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 10

Restricted Range Ratio of Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004-2018

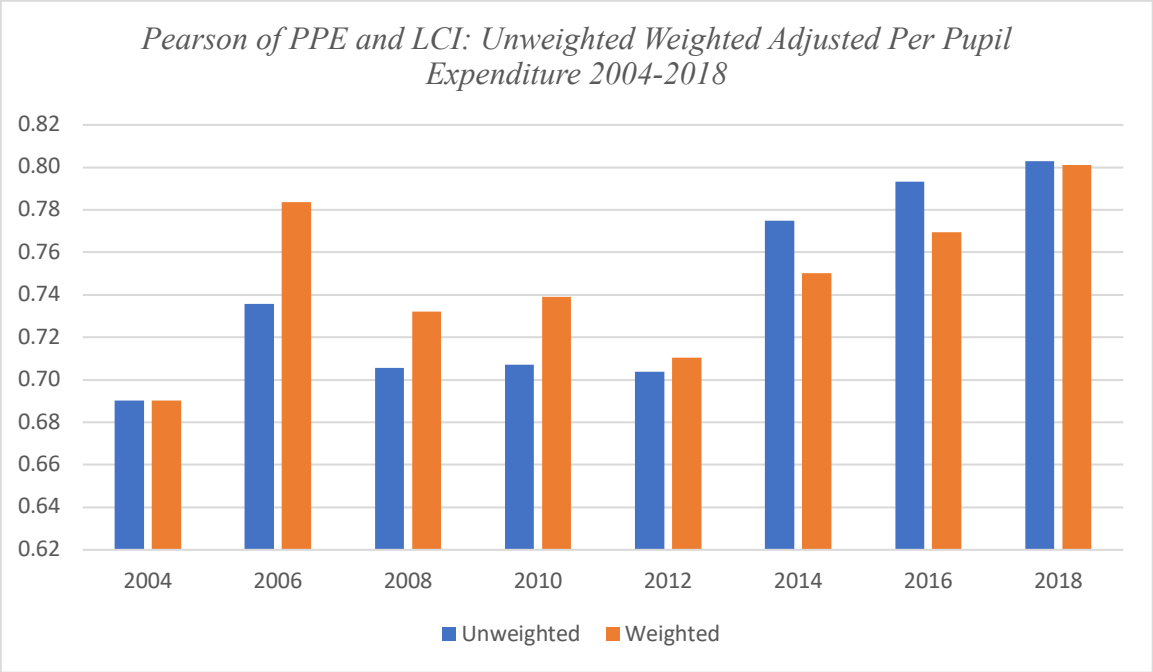


The restricted range ratio is calculating by dividing the total adjusted per pupil expenditures at the top 5% of a distribution by the total adjusted per pupil expenditures at the bottom 5% of the same distribution. This value is represented in a ratio instead of a dollar amount. As with the restricted range, the restricted range ratio is calculated with a focus on the extremes and fails to provide adequate information for the whole distribution of the data set. Over the course of this study, the restricted range ratio reflected multiple fluctuations, but reflected an overall decrease. From FY2004-FY2010, the unweighted restricted range ratio demonstrated continued decrease in value from 0.628 in FY2004 to 0.596 in FY2010. There was an increase in the value from FY2010 to FY2012, suggesting a decrease in equity, before decreasing again in FY2014. A similar pattern followed in FY2016 and FY2018 as the unweighted restricted range ratio increased again before decreasing in FY2018. The weighted restricted range ratio reflected more fluctuations than the unweighted value. Increases in the weighted restricted range ratio were reflected between FY2004 and FY2006, between FY2008 and FY2010, and between FY2014 and FY2016. Between FY2004 and FY2018, the values for both the unweighted and weighted restricted range ratio decreased, thus, reflecting an increase in equity.

Figure 11 reflects the unweighted and weighted Pearson correlation of adjusted per pupil expenditures and LCI for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 11

Pearson of PPE and LCI: Unweighted Weighted Adjusted Per Pupil Expenditure 2004-2018

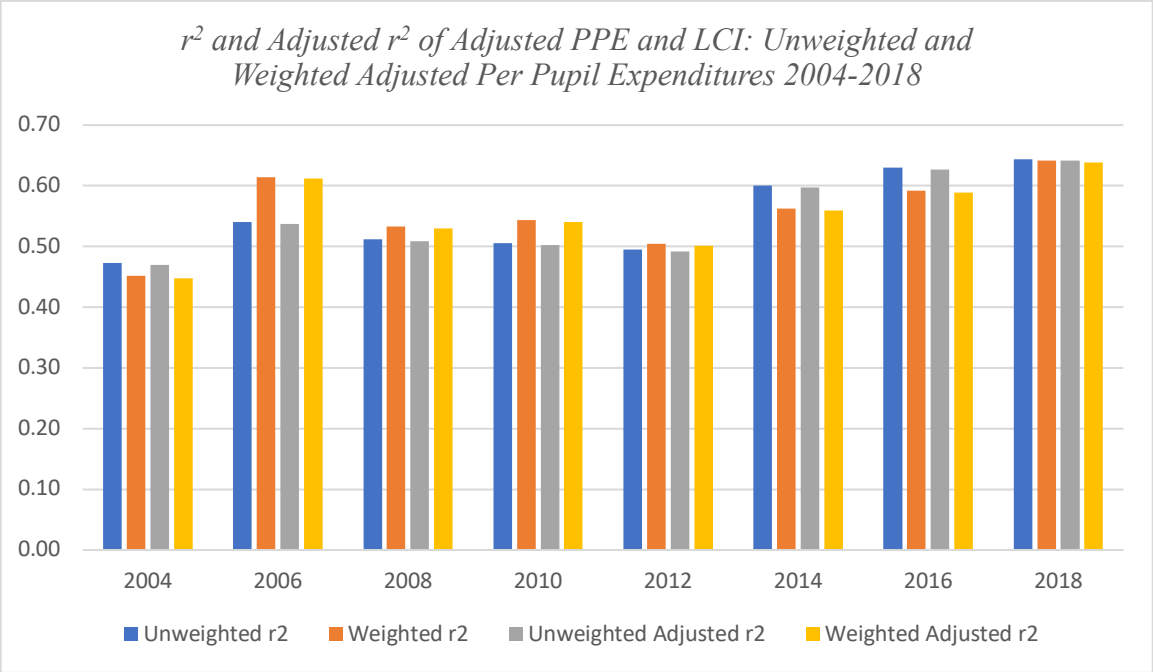


The Pearson correlation is a measure of adjusted per pupil expenditures in relation to a locality's fiscal capacity (referred to as the local composite index or LCI). In FY2004, the Pearson correlation measured the same for both the unweighted and weighted measures at 0.69. Both values increased in FY2006 to 0.736 for the unweighted and 0.784 for the weighted, thus, reflecting a stronger relationship between the adjusted per pupil expenditures and the LCI of divisions. FY2008, FY2010, and FY2012 showed an overall decrease in both the unweighted and weighted values, 0.032 and 0.045 respectively. From FY2012 to FY2018, there was a continued increase in the Pearson correlation for both unweighted and weighted measures, suggesting a positive relationship between the adjusted per pupil expenditures and LCI of divisions. Between FY2004 and FY2018, the unweighted Pearson correlation increased 0.113 and the weighted Pearson correlation increased 0.111, suggesting a strong relationship between the unweighted and weighted adjusted per pupil expenditures and LCI of divisions.

Figure 12 reflects the unweighted and weighted r^2 and adjusted r^2 of adjusted per pupil expenditures and LCI for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 12

r^2 and Adjusted r^2 of Adjusted PPE and LCI: Unweighted and Weighted Adjusted Per Pupil Expenditures 2004-2018



Regression (r^2) is a measure used to determine the percent of a variation between the adjusted per pupil expenditures in a division and the division's LCI. This is represented in a percentage, ranging from 0.0 to 100.0. The adjusted r^2 is another way of measuring this variation but takes into account the number of divisions within the data set. The r^2 never decreases; it increases with each added variable. Since the data set has 132 reporting divisions, the adjusted r^2 provides a more critical analysis of the data set because it only increases if variables improve the measure. The adjusted r^2 is also always lower than the r^2 for this purpose. For this study, both the r^2 and the adjusted r^2 were measured to ensure better accuracy. In FY2004, the unweighted r^2 measured 0.473 and the weighted r^2 measured 0.452. Similarly, the unweighted adjusted r^2 and the weighted adjusted r^2 measured 0.469 and 0.448 respectively. Each of these values increased in FY2006 to the following: 0.540, 0.614, 0.537, and 0.611. In FY2008, each value decreased to 0.512, 0.533, 0.509, and 0.530 respectively. For the remainder of the measured fiscal years, both

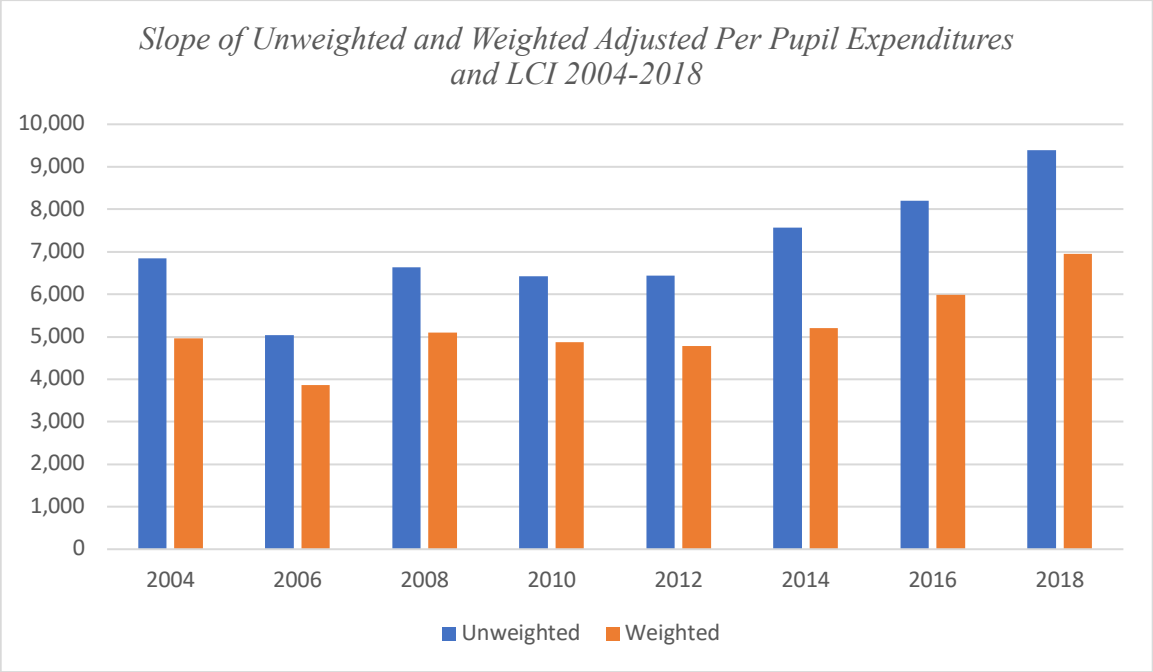
the r^2 and the adjusted r^2 increased continuously. Between FY2004 and FY2018, the unweighted r^2 increased 0.171 and the weighted r^2 increased 0.189; the unweighted adjusted r^2 also increased 0.173 and the weighted adjusted r^2 increased 0.19, suggesting a decline in horizontal and vertical equity and fiscal neutrality.

Regarding the overall results of both the r^2 and the adjusted r^2, there is also a lack of heterogeneity of variance in the unweighted and weighted regressions for this study. Heterogeneity of variance, also referred to as heteroscedasticity, is a statistical error that results when there is a large variance between values in a data set (Howell, 2013). As illustrated in Figure 12, the unweighted and weighted regressions reflect a lack of heteroscedasticity, thus suggesting that, despite having varying LCIs and values of adjusted per pupil expenditures (both unweighted and weighted), there is not a significant variance among the values across each biennium. This limited variance across each measured biennium and the entire duration of the study can be attributed to the measurement of fiscal capacity in the Commonwealth of Virginia, which remained relatively unchanged since 1989.

Figure 13 reflects the unweighted and weighted slope of adjusted per pupil expenditures and LCI for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 13

Slope of Unweighted and Weighted Adjusted Per Pupil Expenditures and LCI 2004-2018

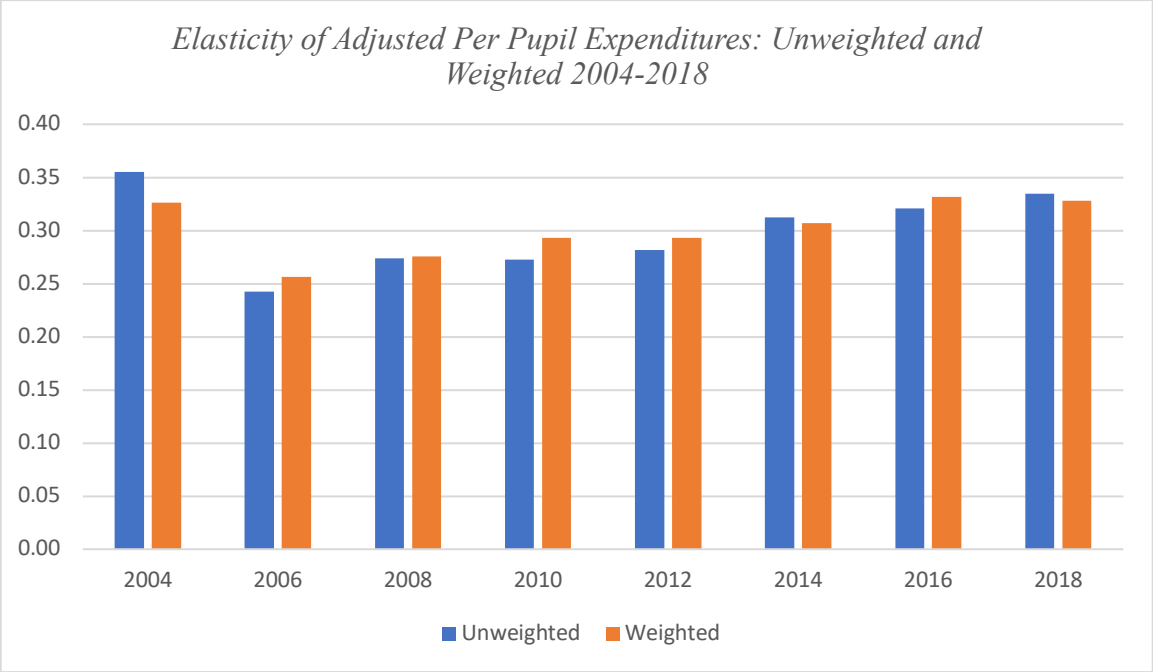


The slope represents the rate of change in the adjusted per pupil expenditures in relation to the fiscal capacity of a division in absolute terms. In FY2004, the unweighted slope was 6,853 and the weighted slope was 4,969. Both values decreased in FY2006 to 5,031 and 3,871 respectively, suggesting an increase in fiscal neutrality. In FY2008, the unweighted slope increase to 6,632 and the weighted slope increased to 5,103, suggesting a decrease in fiscal neutrality. For both FY2010 and FY2012, the unweighted and weighted slope decreased to 6,421 and 4,878 respectively. From FY2014 to FY2018, the slope for both the unweighted and weighted measures increased on a continuous basis, reaching its highest measures in FY2018 (9,388 & 6,954 respectively). Over the course of the measured fiscal years, the unweighted slope increased 2,535 and the weighted slope increased 1,985 suggesting a decrease in fiscal neutrality of divisions in the Commonwealth of Virginia between FY2004 and FY2018.

Figure 14 reflects the unweighted and weighted elasticity of adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 14

Elasticity of Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004 - 2018

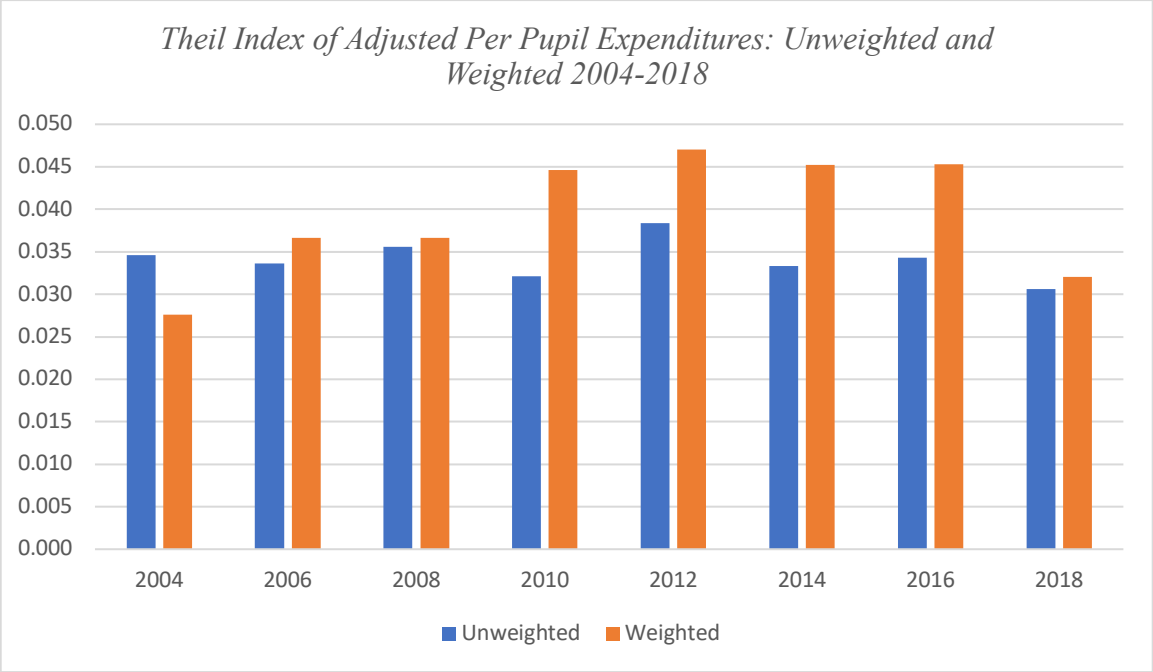


Similar to the slope, the elasticity measures the rate of change in the adjusted per pupil expenditures in relation to the LCI of a division. This is expressed as a percent instead of absolute terms. From FY2004 to FY2006, there was a decrease in the elasticity for both the unweighted and weighted measures: -0.1125 and -0.07 respectively, which were the all-time low measures for the study. For the remainder of the study, the values either remained constant or increased, with the exception of the unweighted measure in FY2010, which slightly decreased 0.0014. While there was a general increase in the elasticity from FY2010 to FY2018, over the course of the fiscal years measured, the elasticity decreased. This decrease suggests a decrease in the magnitude of the relationship between the adjusted per pupil expenditures in relation to the LCI of a division. However, the findings also suggest that while the overall elasticity decreased over the fourteen-year period, the magnitude of the relationship between the adjusted per pupil expenditures in the relation to the LCI of a division gradually increased from FY2006 to FY2018.

Figure 15 reflects the unweighted and weighted Theil Index of adjusted per pupil expenditures for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 15

Theil Index of Adjusted Per Pupil Expenditures: Unweighted and Weighted 2004 -2018



The Theil Index measures the variation of the adjuster per pupil expenditures across the entire data set. In FY2004, the unweighted Theil Index measured 0.0346 and the weighted Theil Index measured 0.0276. This was the only fiscal year that the unweighted measure was greater than the weighted measure; however, this is likely due to the limited data for applying weights to the distribution. From FY2004 to FY2010 the unweighted Theil Index fluctuated while the weighted Theil Index continuously increased. By FY2010, the unweighted Theil Index measured 0.0321 and the weighted Theil Index measured 0.0446 suggesting an increase in horizontal equity and a decrease in vertical equity for that period of time. Both the unweighted and weighted Theil Indices fluctuated from FY2010 to FY2016, reflecting increases and decreasing values every other measured year. By FY2018, however, the unweighted Theil Index measured 0.0306 and the weighted Theil Index measured 0.0320, suggesting that the horizontal equity increased from FY2004 to FY2018 and the vertical equity decreased from FY2004 to FY2018.

The Gini Coefficient

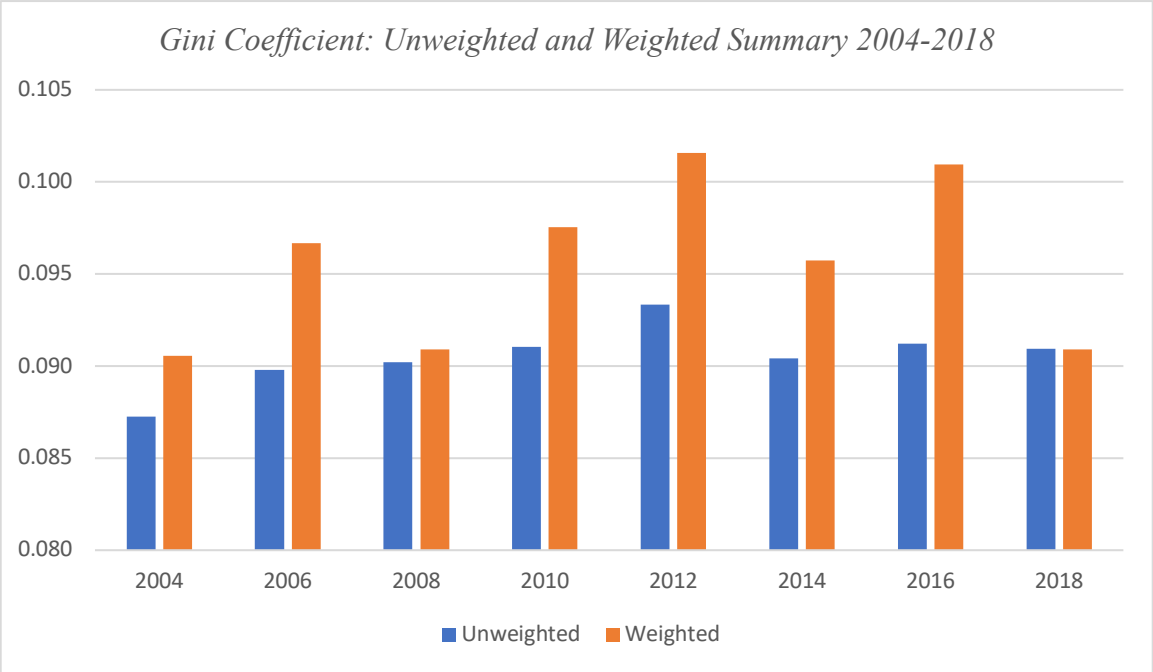
The second section of this chapter reports the findings of the Gini Coefficient with Lorenz Curve. The Gini Coefficient is reported both in a summary table and individual tables by year in order to better illustrate and report the findings. For this measure, data from the Virginia

Department of Education to include the adjusted per pupil expenditures for each reporting division as well as the total student population for each division (i.e., the reported average daily membership or ADM) were utilized. The findings for the Gini Coefficient are in Figures 16-31.

Figure 16 reflects the unweighted and weighted Gini Coefficient for divisions in the Commonwealth of Virginia for each biennium from FY2004 through FY2018.

Figure 16

Gini Coefficient: Unweighted and Weighted Summary 2004-2018



To measure the Gini Coefficient, one must first measure the Lorenz Curve. The Lorenz Curve is a representation of how far plotted data points deviate from absolute equity. When graphed, this line of absolute equity measures at a 45 degree angle. The Lorenz Curve plots the adjusted per pupil expenditures, both unweighted and weighted in relation to the line of absolute equity. The Gini Coefficient measures the space below the Lorenz Curve and the line of absolute equity. The graphical representation of the unweighted and weighted Lorenz Curve and Gini Coefficient can be found on Figures 17-24.

In FY2004, the unweighted Gini Coefficient was 0.0873 and the weighted was 0.906. Both values increased in FY2006 to 0.0898 and 0.0967 respectively, suggesting a decrease in equity measures for that biennial. The unweighted Gini Coefficient increased slightly in FY2010 by 0.0004, suggesting a slight further decrease in equity, but the weighted Gini Coefficient

dropped by -0.0058. From FY2008 to FY 2012, the Gini Coefficient increased for both the unweighted and weighted measures, reflecting its highest values in FY2012 and the least equitable fiscal year for both unweighted and weighted values— 0.09333 and 0.1016 respectively. Over the duration of the measured years, the unweighted Gini Coefficient increased 0.036 and the weighted Gini Coefficient increased 0.003, suggesting that the equity of adjusted per pupil expenditures across the Commonwealth has decreased over a fourteen-year period for both unweighted and weighted counts; in other words, this would suggest a decrease in both horizontal and vertical equity.

Figures 17 and 18 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2004.

Figure 17

2004 Unweighted Gini Coefficient with Lorenz Curve

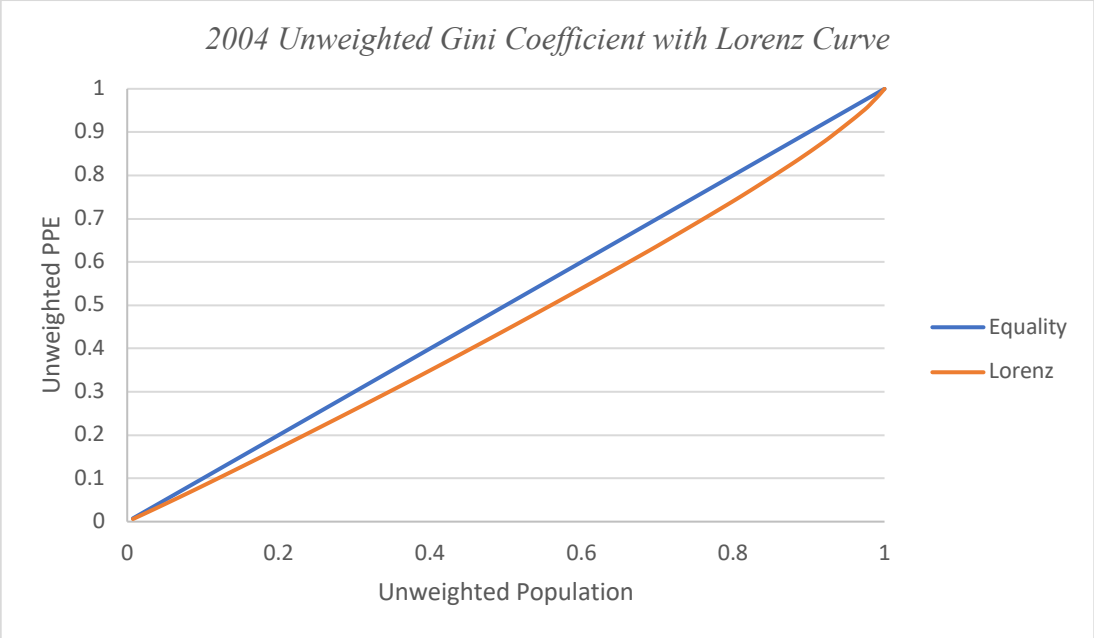
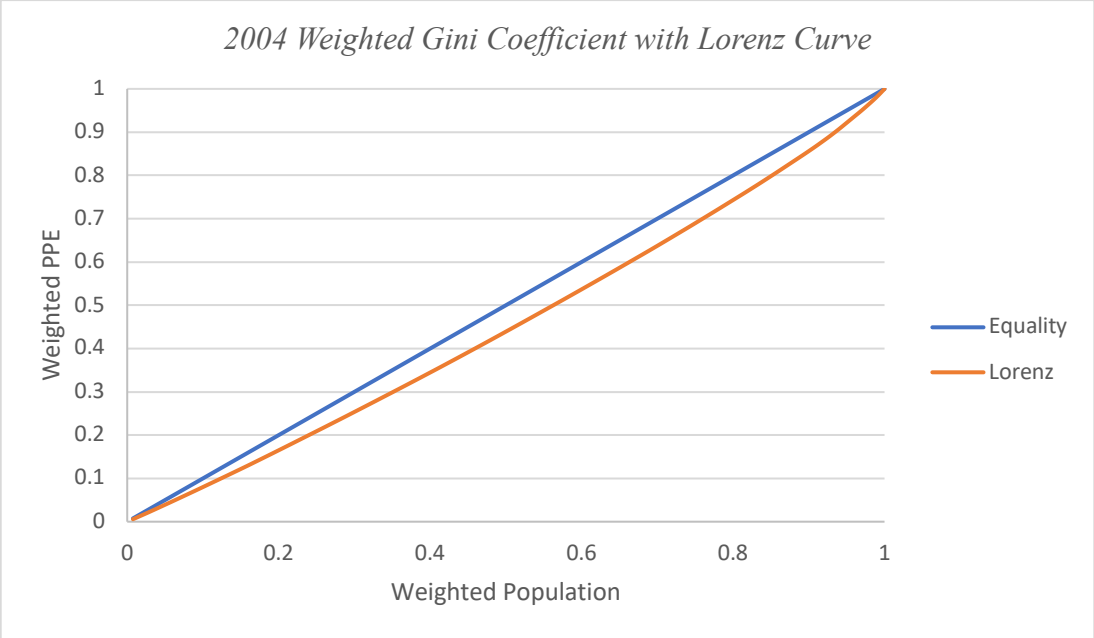


Figure 18

2004 Weighted Gini Coefficient with Lorenz Curve



In FY2004, the unweighted and weighted Gini Coefficient measured similarly. The unweighted Gini Coefficient measured 0.0873 and the weighted Gini Coefficient measured 0.0906. Juxtaposing the two results, the weighted Gini Coefficient is slightly more equitable than the unweighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2004.

Figures 19 and 20 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2006.

Figure 19

2006 Unweighted Gini Coefficient with Lorenz Curve

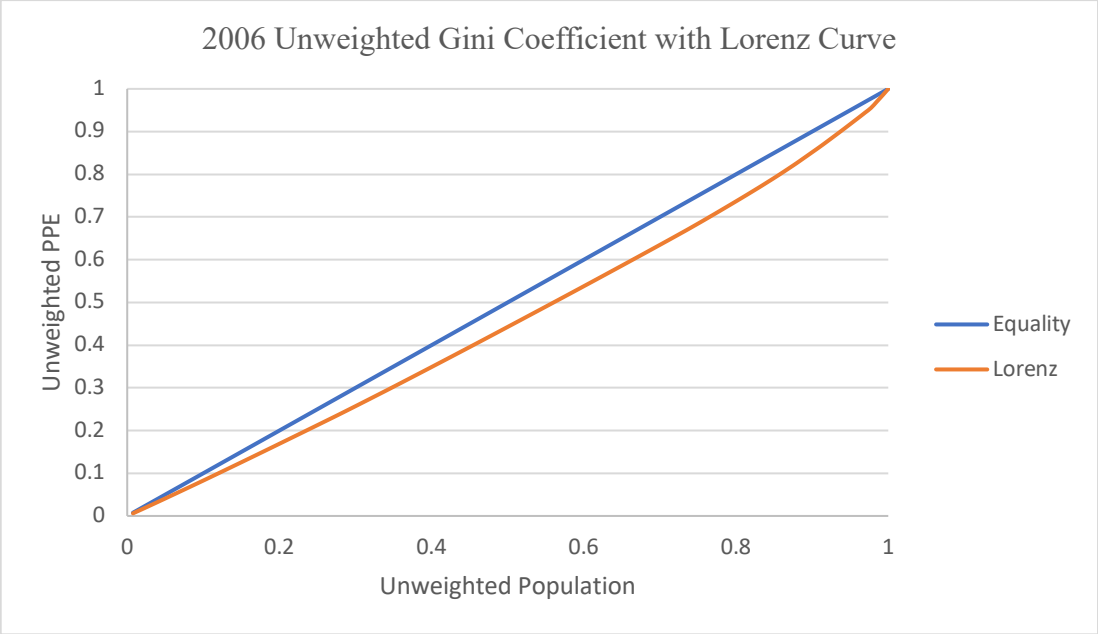


Figure 20

2006 Weighted Gini Coefficient with Lorenz Curve

In FY2006, the unweighted Gini Coefficient measured 0.0898 and the weighted Gini Coefficient measured 0.0967. Juxtaposing the two results, the weighted Gini Coefficient is

slightly more equitable than the unweighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2006.

Figures 21 and 22 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2008.

Figure 21

2008 Unweighted Gini Coefficient with Lorenz Curve

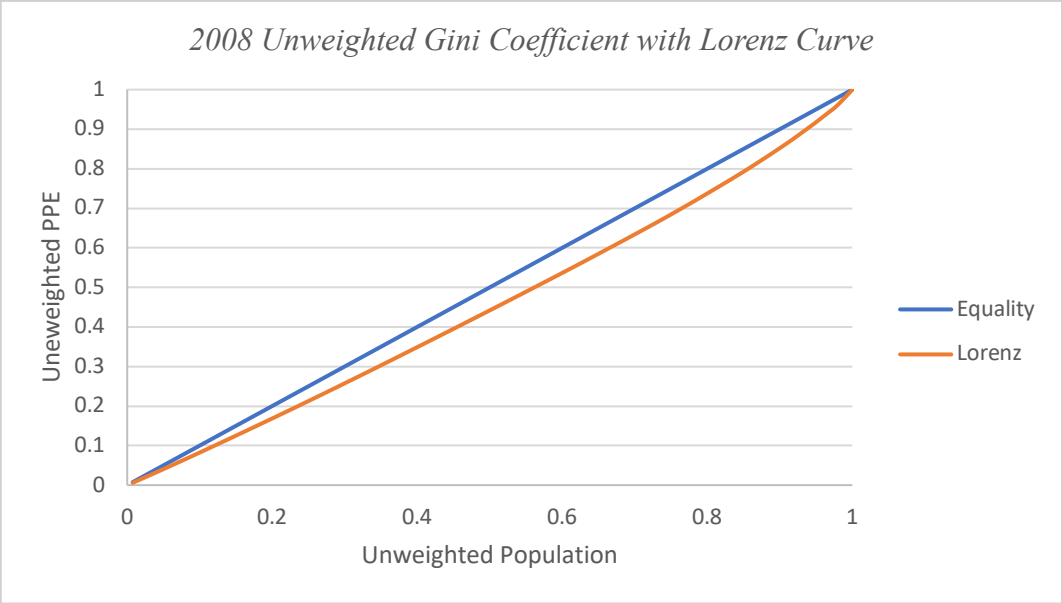
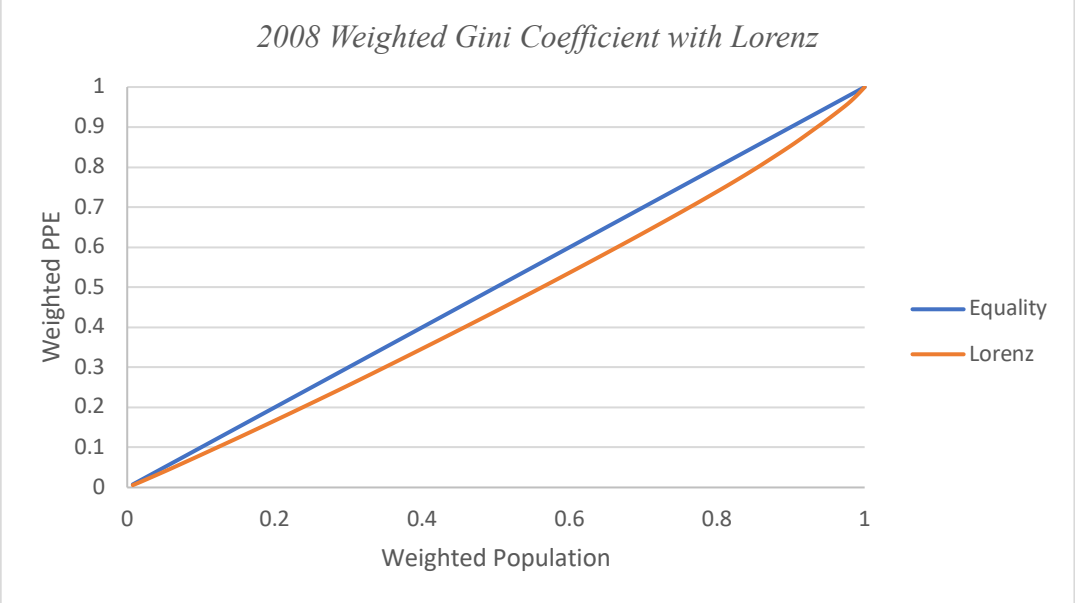


Figure 22

2008 Weighted Gini Coefficient with Lorenz



In FY2008, the unweighted Gini Coefficient measured 0.0902 and the weighted Gini Coefficient measured 0.0909. Juxtaposing the two results, the weighted Gini Coefficient is slightly less equitable than the unweighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2008.

Figures 23 and 24 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2010.

Figure 23

2010 Unweighted Gini Coefficient with Lorenz Curve

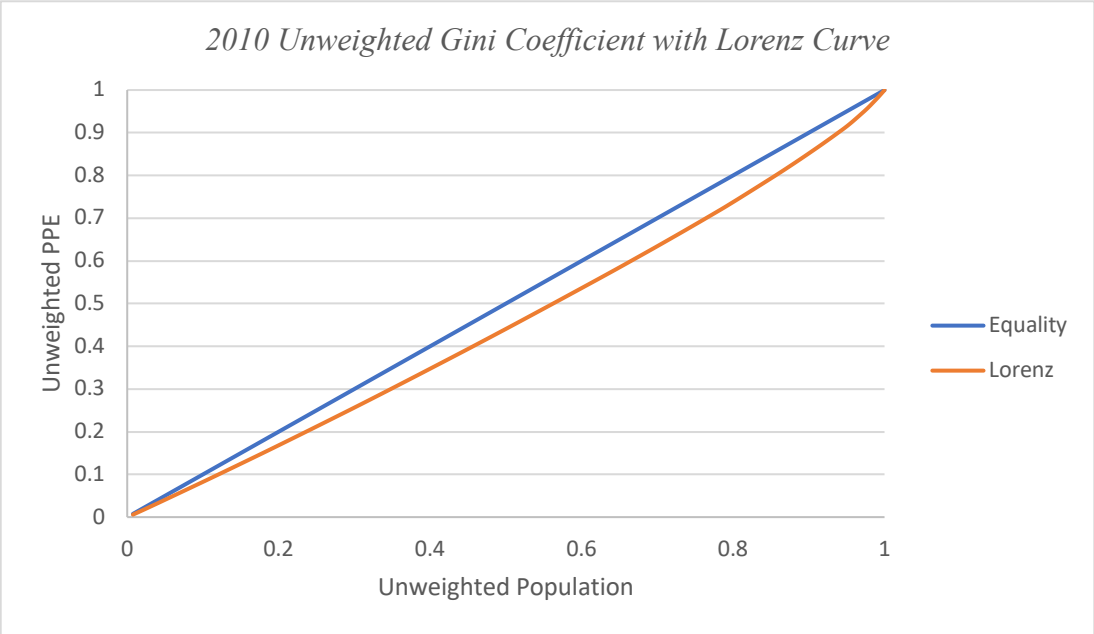
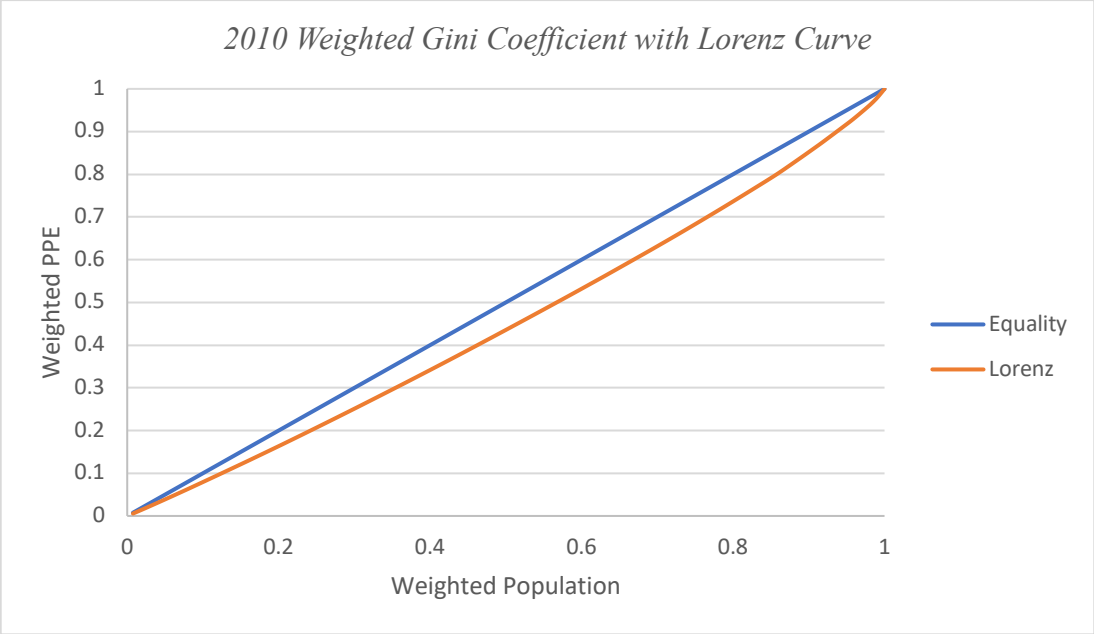


Figure 24

2010 Weighted Gini Coefficient with Lorenz Curve



In FY2010, the unweighted Gini Coefficient measured 0.0911 and the weighted Gini Coefficient measured 0.0975. Juxtaposing the two results, the unweighted Gini Coefficient is slightly less equitable than the weighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2010.

Figures 25 and 26 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2012.

Figure 25

2012 Unweighted Gini Coefficient with Lorenz Curve

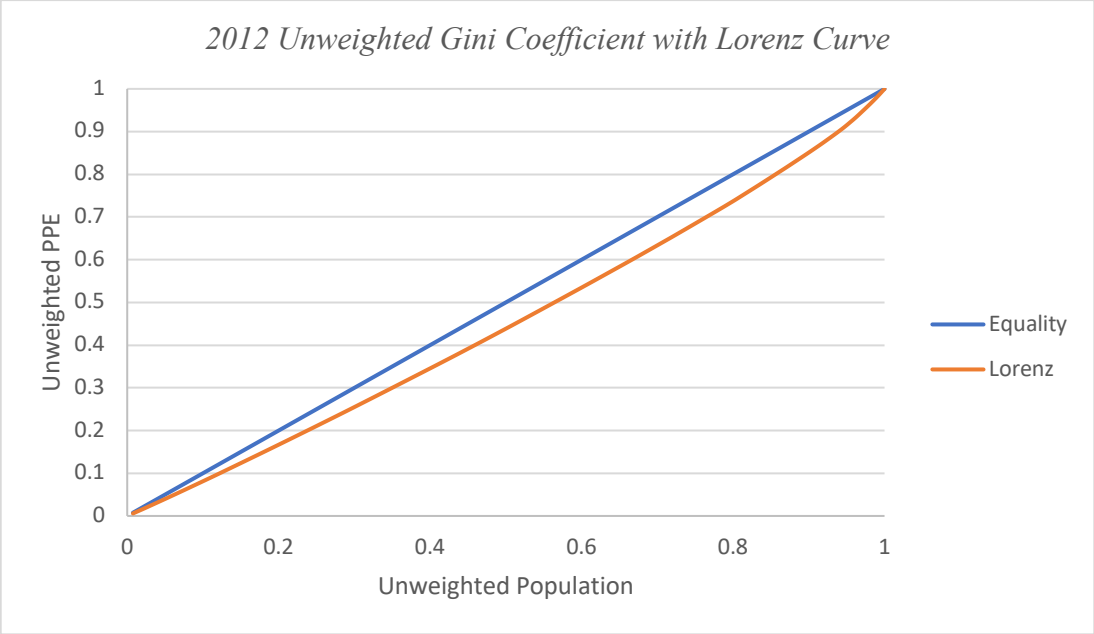
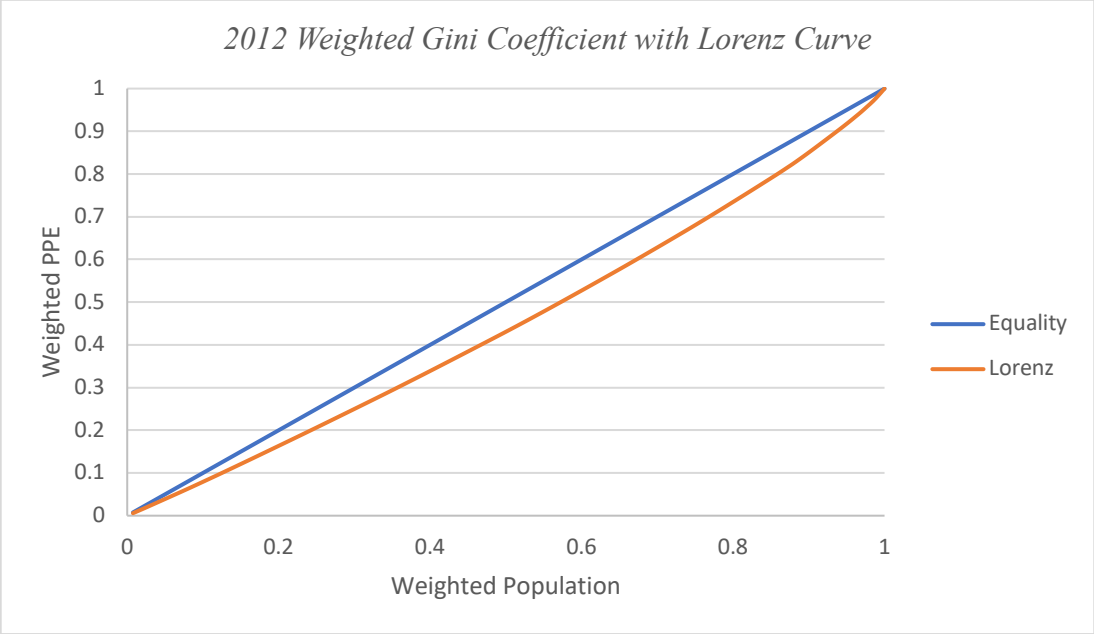


Figure 26

2012 Weighted Gini Coefficient with Lorenz Curve



In FY2012, the unweighted Gini Coefficient measured 0.0933 and the weighted Gini Coefficient measured 0.1016. Juxtaposing the two results, the unweighted Gini Coefficient is

slightly less equitable than the weighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2012.

Figures 27 and 28 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2014.

Figure 27

2014 Unweighted Gini Coefficient with Lorenz Curve

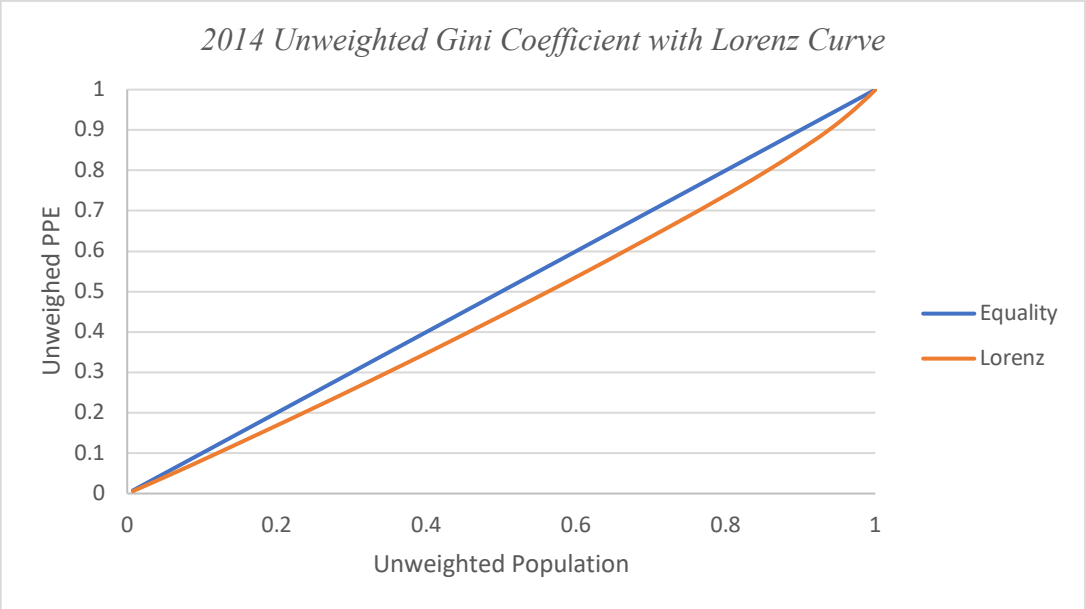
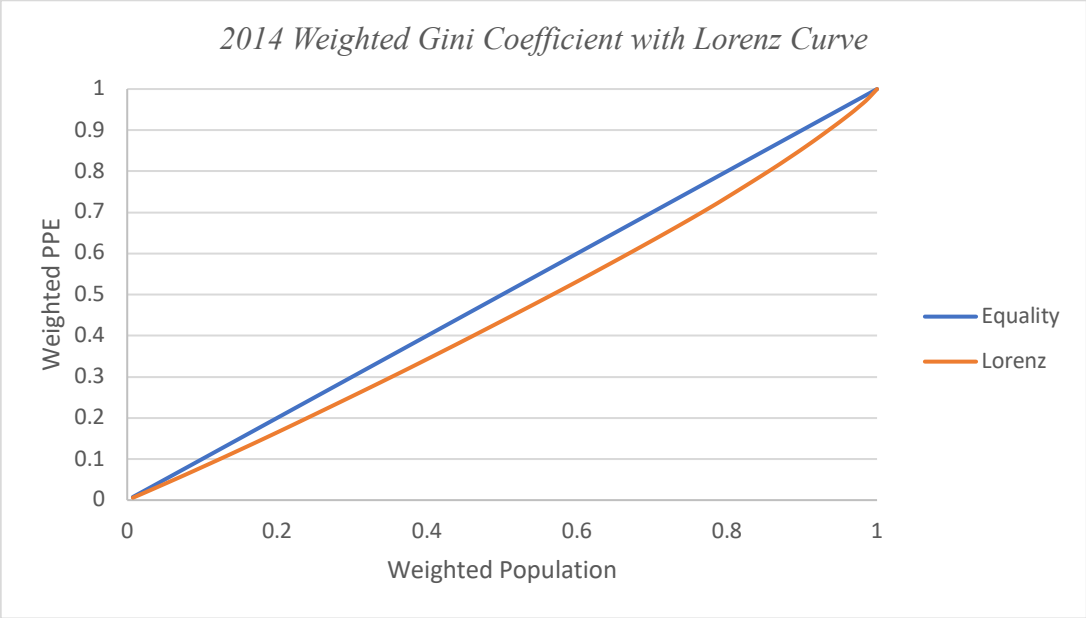


Figure 28

2014 Weighted Gini Coefficient with Lorenz Curve



In FY2014, the unweighted Gini Coefficient measured 0.0904 and the weighted Gini Coefficient measured 0.0957. Juxtaposing the two results, the unweighted Gini Coefficient is slightly less equitable than the weighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2014.

Figures 29 and 30 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2016.

Figure 29

2016 Unweighted Gini Coefficient with Lorenz Curve

Figure 30

2016 Weighted Gini Coefficient with Lorenz Curve

In FY2016, the unweighted Gini Coefficient measured 0.0912 and the weighted Gini Coefficient measured 0.1009. Juxtaposing the two results, the unweighted Gini Coefficient is slightly less equitable than the weighted; this would mean that the vertical equity measures were more favorable than the horizontal equity measures for FY2016.

Figures 31 and 32 reflect the unweighted and weighted Gini Coefficient respectively for divisions in the Commonwealth of Virginia for FY2018.

Figure 31

2018 Unweighted Gini Coefficient with Lorenz Curve

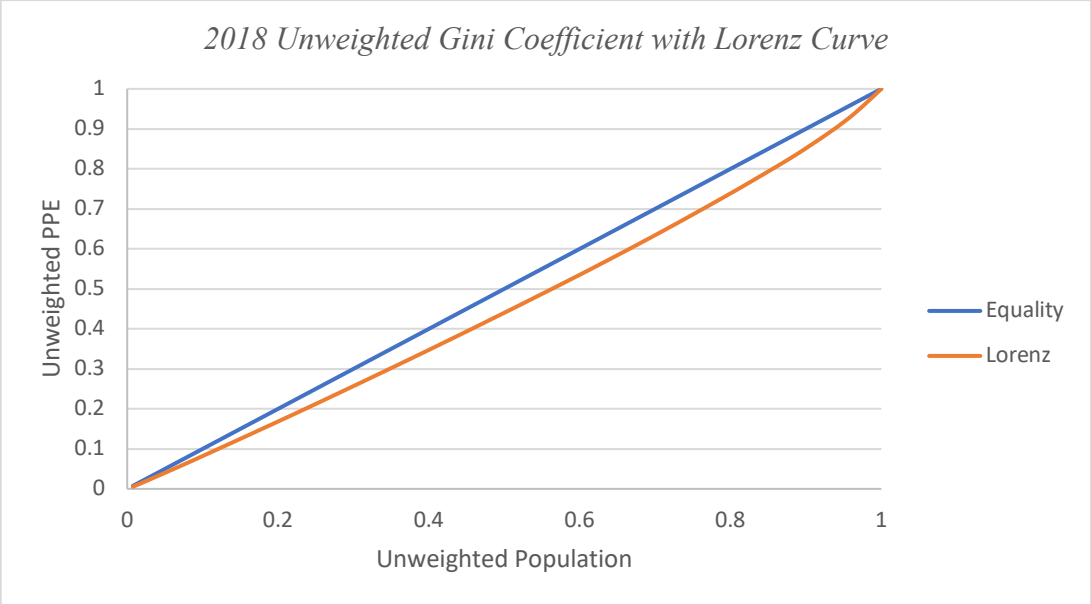
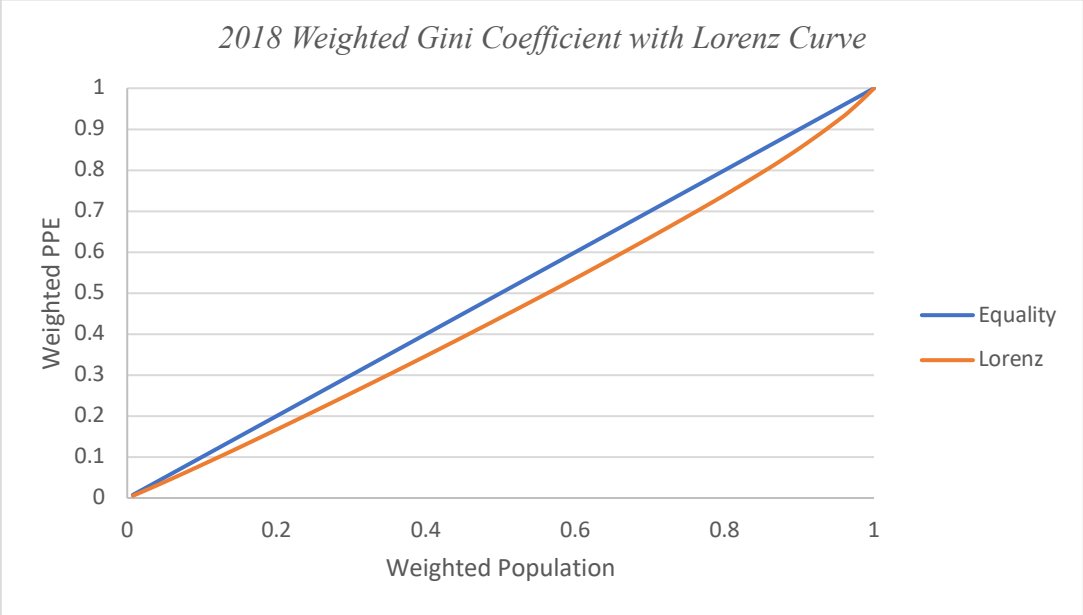


Figure 32

2018 Weighted Gini Coefficient with Lorenz Curve



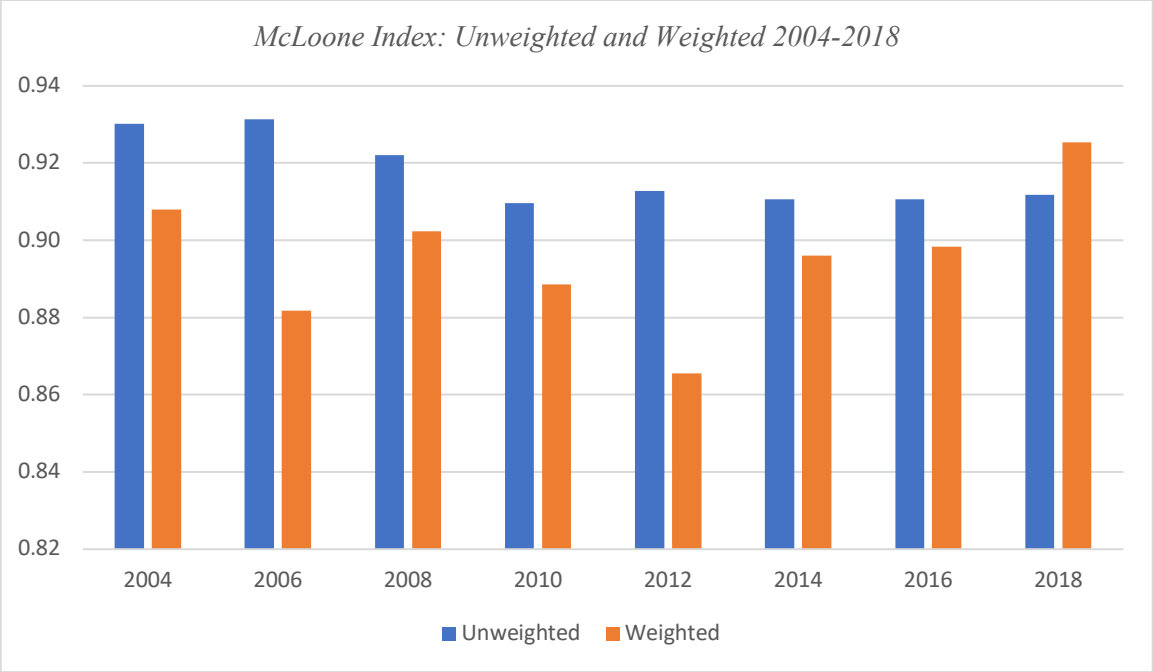
In FY2018, both the unweighted and weighted Gini Coefficient measured at 0.0909. For this year, the vertical equity measures were the same as the horizontal equity measures; however, they were less equitable than the year measured prior.

The McLoone Index

The third and final section of this chapter reports the findings of the McLoone Index. For this measure, data from the Virginia Department of Education were utilized to include the adjusted per pupil expenditures for each reporting division. Both the unweighted and weighted findings are in Figure 33.

Figure 33

McLoone Index: Unweighted and Weighted 2004-2018



The McLoone Index is an equity statistic that provides a ratio of the values below the median adjusted per pupil expenditures of a data set in relation to the entire data set. This statistically represents the adjusted per pupil expenditures of the lower half of the data set as if they received the median of the adjusted per pupil expenditure of the data set. Over the duration of the study, the value is mostly decreasing, though there are fluctuations. In every year except FY2018, the weighted McLoone Index measured lower that the unweighted McLoone Index. In FY2004, the unweighted McLoone Index measured 0.9301 and the weighted McLoone Index measured 0.9080. In FY2006, the unweighted value increased slightly to 0.9313, which was the highest in the study, and the weighted value decreased to 0.8818, suggesting an increase in horizontal equity and a decrease in vertical equity. FY2008 reflected a decrease in the unweighted measure of -0.0093 and an increase in the weighted measure of 0.0206, suggesting a

decrease in horizontal equity and an increase in vertical equity which persisted in FY2010. FY2012 reflected an increase of 0.0031 in the unweighted measure, suggesting an increase in horizontal equity, while the weighted measure reflected its lowest value of 0.8656, suggesting a decrease in vertical equity. From FY2012 to FY2018, the weighted measure consistently increased, suggesting an increase in vertical equity. The unweighted measure reflected a similar finding; however, the values were lower in FY2018 for the unweighted measure than the weighted, suggesting greater vertical equity than horizontal equity.

Summary

This chapter presented an analysis of data to measure both horizontal and vertical equity of divisions across the Commonwealth of Virginia from FY2004 to FY2018. The chapter was separated into three distinct sections for analysis: (1) descriptive, wealth neutrality, and equity statistics; (2) the Gini Coefficient; and (3) the McLoone Index. Results of the following analyses were presented for both unweighted and weighted values: mean, median, range, restricted range, restricted range ratio, coefficient of variation, regression, slope, elasticity, the Theil Index, the Pearson correlation, the Gini Coefficient, and the McLoone Index. The results of the analyses suggested that both horizontal and vertical equity have decreased over the duration of the study. A more detailed summary and discussion of findings, implications, and suggestions for future research will be presented in Chapter 5.

Chapter 5

Findings, Implications, and Conclusions

Introduction and Restatement of Purpose

The purpose of this chapter is to provide an overview of the study, present the findings of the study, and discuss implications for practice based on the findings. This chapter is separated into three sections: section one focuses on the findings of the study, section two focuses on the implications of the study, and section three focuses on suggestions for future research.

The purpose of this study is to conduct a longitudinal analysis of horizontal and vertical fiscal equity across the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. The two research questions central to the study are the following:

Research Question 1: How has the horizontal equity of school funding changed in the Commonwealth of Virginia since 2004?

Research Question 2: How has the vertical equity of school funding changed in the Commonwealth of Virginia since 2004?

In order to answer these two research questions, information was gathered from the Virginia Department of Education, the Commonwealth Institute, and published JLARC reports. At fixed intervals reflecting FY2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018, data points were drawn from each of the 132 reporting divisions across the Commonwealth of Virginia. Each selected data point reflected the second year of a biennial period in relation to the calculation of the local composite index (LCI). Data such as state and local funding, average daily membership per division, the local composite index of each division, the adjusted expenditures (i.e., expenditures minus federal funds), adjusted per pupil expenditures (i.e., adjusted expenditures divided by average daily membership per division), and classification data to include economically disadvantaged students, special education students, and English language learners were obtained. This study measured changes in fiscal equity over the fourteen-year period with the intention of providing insight to educational leaders and researchers of the current state of fiscal equity in the Commonwealth of Virginia and for potential areas of improvement in fiscal equity measures. Both horizontal and vertical equity measures were analyzed in order to present a more detailed analysis of equity across the selected years. Using the identified years of study, a comparative analysis was conducted to examine the relationship

between horizontal and vertical equity measures across divisions in the Commonwealth of Virginia from FY2004 to FY2018.

Summary and Discussion of Findings

Finding 1

Horizontal equity has decreased in the Commonwealth of Virginia since FY2004. The first finding is a direct response to the first research question of the study. According to various statistical measures presented in Table 4, trend data suggest that horizontal equity has decreased from FY2004 to FY2018. Additionally, despite having varying LCIs and values of adjusted per pupil expenditures, there is not a significant variance among the values across each biennium. This limited variance across each measured biennium and the entire duration of the study can be attributed to the measurement of fiscal capacity in the Commonwealth of Virginia, which remained relatively unchanged since 1989. Between FY2004 and FY2018, there were fluctuations in equity measures to suggest periods of temporarily increased equity, but analysis of the entire duration of the study suggests an overall decrease in horizontal equity since FY2004.

Throughout the dates of the study, the unweighted range increased from 9,243 to 11,724, illustrating the growing difference between divisions with high and low capacity and a decrease in equity. When considering the unweighted restricted range, which excludes the top and bottom 5% of a data set, there was an increase from 3,982 in FY2004 to 5,328 in FY2018. This further suggests that even without the extreme outliers in the data set, the gap between higher capacity divisions and lower capacity divisions grew over the course of the years analyzed.

When examining the unweighted r^2, the unweighted slope, unweighted elasticity, and unweighted Pearson Correlation, it is evident that there was also a decrease in fiscal neutrality for the unweighted data set. The unweighted r^2 increased from FY2004 to FY2018 from 0.473 to 0.644, suggesting a decrease in horizontal equity and fiscal neutrality. The unweighted slope, which is the rate of change in a data set, increased in FY2018 to 9,388 from 6,853 in FY2004. The unweighted elasticity, which is another measure of the rate of change and magnitude of a relationship in a data set, also decreased from FY2004 to FY2018. In FY2004, the unweighted elasticity was 0.3550 and in FY2018 it was 0.3350. The unweighted Pearson Correlation increased from FY2004 to FY2018. In FY2004, the Pearson Correlation measured at 0.690 and in FY2018 it measured at 0.803, suggesting an increased relationship between the LCI of

Table 4

Horizontal Equity and Fiscal Neutrality Findings, Analysis, and Interpretation

Unweighted Measure	Trend Analysis		Interpretation
Range	2004:	9,243	The unweighted range was greater in FY2018 than in FY2004, suggesting a decrease in horizontal equity.
	2018:	11,724	
Restricted Range	2004:	3,982	The unweighted restricted range was greater in FY2018 than in FY2004, suggesting a decrease in horizontal equity.
	2018:	5,328	
Restricted Range Ratio	2004:	0.628	The unweighted restricted range ratio was greater in FY2004 than in FY2018, suggesting an increase in horizontal equity.
	2018:	0.569	
r^2	2004:	0.473	The unweighted r^2 increased between FY2004 and FY2018, suggesting a decrease in horizontal equity.
	2018:	0.644	
Slope	2004:	6,853	The unweighted slope increased between FY2004 and FY2018, suggesting a decrease in fiscal neutrality.
	2018:	9,388	
Elasticity	2004:	0.3550	The unweighted elasticity decreased between FY2004 and FY2018, suggesting a decrease in the magnitude of the relationship between the adjusted per pupil expenditures and the LCI of a division
	2018:	0.3350	
Pearson	2004:	0.690	The unweighted Pearson correlation increased from FY2004 to FY2018, suggesting a strong relationship between the LCI and the unweighted adjusted per pupil expenditures.
	2018:	0.803	
Coefficient of Variation	2004:	0.193	The unweighted CV was lower in FY2004 than FY2018, suggesting a decrease in horizontal equity.
	2018:	0.195	
Theil Index	2004:	0.0346	The unweighted Theil Index was higher in FY2004 than in FY2018, suggesting an increase in horizontal equity.
	2018:	0.0306	
Gini Coefficient	2004:	0.0873	The unweighted Gini Coefficient increased from FY2004 to FY2018, suggesting a decrease in horizontal equity.
	2018:	0.0909	
McLoone Index	2004:	0.9301	The unweighted McLoone Index decreased from FY2004 to FY2018, suggesting a decrease in horizontal equity.
	2018:	0.9118	

divisions and the unweighted adjusted per pupil expenditures. Considering each of these results, it suggests that there was a decrease in horizontal equity and fiscal neutrality from FY2004 to FY2018 for the unweighted values.

Lastly, examining equity statistics like the unweighted CV, unweighted Theil Index, unweighted Gini Coefficient, and unweighted McLoone Index, it is evident that horizontal equity has decreased from FY2004 to FY2018. The unweighted CV decreased slightly from 0.193 to 0.195 between FY2004 and FY2018. The unweighted Theil Index decreased, however, from 0.0346 in FY2004 to 0.0306 in FY2018, suggesting a slight increase in fiscal equity. This was the only equity statistic that measured positively. The unweighted Gini Coefficient increased from FY2004 to FY2018. In FY2004, the unweighted Gini Coefficient was 0.0873 and in FY2018 it was 0.0909. The unweighted McLoone Index, which measures equity for the lower half of a data set in relation to the median of the data set, decreased from FY2004 to FY2018. In

FY2004, the unweighted McLoone was 0.9301 and in FY2018 it decreased to 0.9118. Considering the unweighted CV, unweighted Gini Coefficient, and unweighted McLoone Index it is evident that horizontal equity decreased from FY2004 to FY2018.

This finding is in contrast to Arbogast's (2005) study, which was the last longitudinal analysis of fiscal equity conducted in the Commonwealth of Virginia. The study analyzed fiscal equity for all divisions in the Commonwealth of Virginia from FY1974 to FY2003. Arbogast found that between FY1974 and FY2003, equity measures had increased in divisions, though they had been slowing for the final nine years of the study.

Finding 2

Vertical equity has decreased in the Commonwealth of Virginia since FY2004. The second finding is a direct response to the second research question of the study. According to various statistical measures presented in Table 5, trend data suggest that vertical equity has decreased from FY2004 to FY2018. Vertical equity, often considered the unequal treatment of unequals, was measured by applying weights to identified classifications of students (this was discussed in Chapter 3 and Chapter 4). Additionally, despite having varying LCIs and values of adjusted per pupil expenditures, there is not a significant variance among the values across each biennium. This limited variance across each measured biennium and the entire duration of the study can be attributed to the measurement of fiscal capacity in the Commonwealth of Virginia, which remained relatively unchanged since 1989. Between the dates of the study, there were fluctuations to suggest periods of temporarily increased vertical equity, but analysis of the entire duration of the study suggests an overall decrease in vertical equity from FY2004 to FY2018.

Throughout the dates of the study, the weighted range increased from 6,456 to 9,374, illustrating the growing difference between divisions with high and low capacity and a decrease in equity even with applied weights. Additionally, these values measure below the unweighted range values, but there is less variance in the weighted range than the unweighted range. When considering the weighted restricted range, there was an increase from 3,586 in FY2004 to 4,382 in FY2018. This further suggests that even without the extreme outliers in the data set, the gap between higher capacity divisions and lower capacity divisions grew over the course of the years analyzed. Again, these values measures below the unweighted restricted range. Lastly, the weighted restricted range ratio decreased from 0.726 in FY2004 to 0.615 in FY2018. Each of these values suggest a decrease in vertical equity from FY2004 to FY2018.

Table 5

Vertical Equity and Fiscal Neutrality Findings, Analysis, and Interpretation

Weighted Measure	Trend Analysis		Interpretation
Range	2004:	6,456	The weighted range was greater in FY2018 than in FY2004, suggesting a decrease in vertical equity.
	2018:	9,374	
Restricted Range	2004:	3,586	The weighted restricted range was greater in FY2018 than in FY2004, suggesting a decrease in vertical equity.
	2018:	4,382	
Restricted Range Ratio	2004:	0.726	The weighted restricted range ratio was greater in FY2004 than in FY2018, suggesting an increase in vertical equity.
	2018:	0.615	
r^2	2004:	0.452	The weighted r^2 increased between FY2004 and FY2018, suggesting a decrease in vertical equity.
	2018:	0.641	
Slope	2004:	4,969	The weighted slope increased between FY2004 and FY2018, suggesting a decrease in fiscal neutrality.
	2018:	6,954	
Elasticity	2004:	0.326	The weighted elasticity increased between FY2004 and FY2018, suggesting a increased in the magnitude of the relationship between the adjusted per pupil expenditures and the LCI of a division
	2018:	0.328	
Pearson	2004:	0.690	The weighted Pearson correlation increased from FY2004 to FY2018, suggesting a strong relationship between the LCI and the unweighted adjusted per pupil expenditures.
	2018:	0.801	
Coefficient of Variation	2004:	0.183	The weighted CV was lower in FY2004 than FY2018, suggesting a decrease in vertical equity.
	2018:	0.191	
Theil Index	2004:	0.0276	The weighted Theil Index was lower in FY2004 than in FY2018, suggesting an decrease in vertical equity.
	2018:	0.0320	
Gini Coefficient	2004:	0.0906	The weighted Gini Coefficient increased from FY2004 to FY2018, suggesting a decrease in vertical equity.
	2018:	0.0909	
McLoone Index	2004:	0.9080	The weighted McLoone Index increase from FY2004 to FY2018, suggesting a increase in vertical equity.
	2018:	0.9254	

When examining the weighted r^2, slope, weighted elasticity, and weighted Pearson Correlation, it is evident that there was also a decrease in fiscal neutrality for the weighted data set. The weighted r^2 increased from FY2004 to FY2018 from 0.452 to 0.641, suggesting a decrease in vertical equity and fiscal neutrality. The weighted slope increased in FY2018 to 6,954 from 4,969 in FY2004. The weighted elasticity, increased from FY2004 to FY2018. In FY2004, the weighted elasticity was 0.326 and in FY2018 it was 0.328. The weighted Pearson Correlation increased from FY2004 to FY2018. In FY2004, the Pearson Correlation measured at 0.690 and in FY2018 it measured at 0.801, suggesting an increased relationship between the LCI of divisions and the weighted adjusted per pupil expenditures. The Pearson Correlation for the unweighted and weighted values was nearly identical. Considering each of these results, it

suggests that there was a decrease in vertical equity and fiscal neutrality from FY2004 to FY2018 for the weighted values.

Lastly, examining equity statistics like the weighted CV, weighted Theil Index, weighted Gini Coefficient, and weighted McLoone Index, it is evident that vertical equity has decreased from FY2004 to FY2018. The weighted CV decreased slightly from 0.183 to 0.191 between FY2004 and FY2018. The weighted Theil Index increased from 0.0276 in FY2004 to 0.0320 in FY2018, suggesting a decrease in fiscal equity. The weighted Gini Coefficient increased slightly from FY2004 to FY2018. In FY2004, the unweighted Gini Coefficient was 0.0906 and in FY2018 it was 0.0909. The weighted McLoone Index, increased from FY2004 to FY2018; this was the only year where the weighted value was greater than the unweighted value. It was also the only equity statistic that measured positively for the weighted values. Further analysis of the McLoone results will follow. In FY2004, the weighted McLoone was 0.9080 and in FY2018 it increased to 0.9254. Considering the weighted CV, the weighted Theil Index, and the weighted Gini Coefficient, it is evident that vertical equity decreased from FY2004 to FY2018.

At this time, there has not been another longitudinal analysis of vertical equity in the Commonwealth of Virginia. However, there is great variability in the needs of divisions in relation to the weighted categories of this study. Between FY2004 and FY2018, students identified as economically disadvantaged, special education, or English language learners made up anywhere from 8% of a division's population to 100%. Additionally, from FY2004 to FY2018, the number of students identified as economically disadvantaged, special education, or English Language learners increased by 269,634. This increase in categorical student counts suggests a growing need for school finance reform, especially in relation to vertical equity measures. According to Berne and Stiefel (1984), vertical equity is the "least frequently examined principle" of equity because it is the "most methodologically demanding" to measure (p.103), but this study provides information to policymakers and educational leaders to begin considering amendments to the means and methods of funding allocations for divisions in the Commonwealth of Virginia.

Finding 3

The McLoone Index results in FY2018 were an outlier in relation to the other fiscal years measured. The third finding, though not directly correlated to the research questions, results from an outlier result within the study. In FY2018, the McLoone Index for the weighted values

was the only instance of the McLoone Index measuring more equitably than the unweighted McLoone Index. The results to the McLoone Index for both the unweighted and weighted values can be found in Table 6.

Table 6

Unweighted and Weighted McLoone Index Results

	2004	2006	2008	2010	2012	2014	2016	2018
Unweighted McLoone	0.9301	0.9313	0.9220	0.9097	0.9128	0.9106	0.9106	0.9118
Weighted McLoone	0.9080	0.8818	0.9024	0.8886	0.8656	0.8961	0.8983	0.9254

For each McLoone Index value, except FY2018, the weighted value is less than the unweighted value. This is due to the nature and method of how the McLoone Index is calculated. In order to measure the McLoone Index, one must determine the median division for adjusted per pupil expenditures and the rank of the division identified. In FY2018, the median for weighted adjusted per pupil expenditures ranked the higher than the unweighted; it was the only year where this pattern occurred. This is illustrated in Table 7. Additionally, more students identified as economically disadvantaged students, special education students, and English language learners fell above the median than any other year for both weighted and unweighted counts. These instances directly impact the results of the McLoone Index, resulting in a value that reflects a more equitable fiscal scenario when weights are applied to the students for fiscal reasons.

Table 7

Unweighted and Weighted Median Ranks and Student Counts

	2004	2006	2008	2010	2012	2014	2016	2018
Unweighted Median Rank	74th Division	85th Division	85th Division	90th Division	87th Division	85th Division	80th Division	83rd Division
# of Total Students Above Median	579,462	541,655	607,037	566,233	624,194	566,981	568,563	572,261
# of Total Students Below Median	535,250	598,166	618,168	601,930	621,598	621,076	627,728	629,850
Categorical Students Above Median	281,330	272,912	306,245	280,937	353,460	334,247	330,782	355,840
Categorical Students Below Median	222,369	278,842	293,262	299,310	348,334	372,967	370,801	381,658
Weighted Median Rank	76th Division	91st Division	91st Division	92nd Division	94th Division	89th Division	82nd Division	75th Division
# of Total Students Above Median	732,880	693,081	757,740	734,768	744,565	800,272	823,707	847,543
# of Total Students Below Median	743,771	832,724	771,417	833,544	877,922	855,268	839,248	838,971
Categorical Students Above Median	386,347	415,204	443,490	411,724	460,682	521,467	534,368	590,250
Categorical Students Below Median	444,471	524,586	473,138	568,672	648,630	653,230	633,879	610,086

Most noteworthy from this chart is the rank of the median for FY2018 in relation to the others for both the unweighted and weighted values. For FY2018, the median fell higher for the weighted data set than the unweighted. The number of categorical students identified above the median is also noteworthy because more categorical students were identified above the median. Considering only the divisions above the unweighted median, the mean LCI is 0.5320, in contrast to the value below the median, which is 0.3153. Likewise, considering only the divisions above the weighted median, the mean LCI is 0.5100, in contrast to the value below the median, which is 0.3090. This suggests that with divisions above the median, for both the weighted and unweighted values, there are more students identified as economically disadvantaged, special

education, or English language learners, but the divisions have a greater fiscal capacity, thus creating a more equitable scenario for school funding.

This is the first analysis of both the horizontal and vertical equity of school finance in the Commonwealth of Virginia. However, Arbogast (2005) measured the McLoone Index of the unweighted values and found that the McLoone value increased from 0.8707 in FY1975 to 0.9351 in FY2003. This does not align with the findings of this study, which found an overall decrease in the McLoone Index throughout the duration of the study (for the unweighted values).

Implications of Findings

After having reviewed the findings in this research, the following implication has been identified: **In order to increase fiscal equity, Virginia should reconsider the means and methods for calculating school funding for divisions across the Commonwealth.**

The results of the FY2018 McLoone Index relate back to Driscoll and Salmon (2013) where they project the impact of the growing population in the Commonwealth of Virginia. Currently, Virginia's population is projected to reach 8.5 million by 2025, which is also coupled with a projected increase in diversity as well. As the population in the Commonwealth of Virginia continues to grow in size and becomes increasingly diverse, the educational leaders of the Commonwealth of Virginia will be faced with meeting the changing needs of students. Even more, in the wake of the ongoing COVID-19 pandemic, divisions will be faced with maintaining equity standards especially in areas serving low income students, students in poverty, and bilingual students in the wake of a recession (Baker, 2014; Knight, 2017).

The current funding formula for calculating the fiscal capacity of divisions across the entire Commonwealth of Virginia has been relatively unchanged since 1989 (Alexander & Salmon, 2019). Researchers have acknowledged imperfections persist with the current funding formula due to its reliance upon outdated data and a cap of 0.8000, despite some divisions having a greater capacity (which can be calculated by the methods outlined in Chapter 3) (Salmon, 2010; Salmon & Alexander, 2019). The results of this study illustrate a growing need for a change in the current funding formula and practices for the Commonwealth of Virginia. Since 2004, both horizontal and vertical equity have decreased; the needs of the Commonwealth of Virginia are projected to continue to change and evolve and the last few years of the study reflect this as well. By considering the a more accurate cost for educating students with differing needs (e.g., economically disadvantaged students, special education students, and English language

learners), divisions have an opportunity to further provide more equitable services to their students. All of this data is collected on an annual basis; school leaders and the Virginia General Assembly must work collaboratively to update the funding formula so that it does not mathematically equalize each student. This could help decrease funding disparities between higher and lower capacity divisions.

Conclusions

The Virginia Department of Education launched its equity framework, Navigating EdEquityVA, in 2020. In the framework, equity priorities and standards are outlined. Additionally, tools to achieve those standards and priorities are provided. In the document, it states that the Commonwealth of Virginia is committed to equity through eliminating opportunity gaps and focused on "dismantl[ing] any and all forms of inequity in Virginia's public education system" (VDOE, 2020). While there is a section in the document that references the resourcing of schools, there is no plan for revamping how schools are funded. Instead, the focus is placed on elements outlined in the Standards of Quality (SOQs) such as class sizes, counselor ratios, support staff ratios, and school psychologist ratios.

Additionally, the most recent fiscal equity court case was Scott v. Commonwealth in 1991, where the courts deemed that while funding equity would be ideal, it is not required by the state constitution. To fully commit to providing an equitable educational experience to all students, as the Commonwealth of Virginia has recently published a commitment to, changes to the means and manner of funding education must also adapt to a more equitable standard. Aligning funding practices to the new focus of the Virginia Department of Education's Navigating EdEquityVa is the first step to eliminating disparities in funding and ensuring that students across the entire Commonwealth are afforded the same degree and quality of education despite their wealth, locality, or background. Adjusting the funding formula to reflect more equitable measurement would further ensure the Virginia Department of Education's commitment to equity.

Suggestions for Future Research

Previously, an historical analysis of the fiscal equity of school funding was conducted by Arbogast (2005). That analysis measured horizonal equity from 1974 – 2003. Since then, there has not been another longitudinal analysis of fiscal equity in the Commonwealth of Virginia.

Over the course of this fourteen-year study, trends emerged as they related to both horizontal and vertical fiscal equity. The emergent trends presented information that helped to better illustrate the state of school funding measures in the Commonwealth of Virginia along with their equitability.

The researcher recommends future studies continue the analysis of fiscal equity after FY2018, especially with the current state of the economy and the occurrence of the global Coronavirus pandemic (COVID-19). This study was unable to gather sufficient information for the final biennium to include information pertaining to FY2020 for analysis, so data was only measured through FY2018. Therefore, anything pertaining to fiscal impact of COVID-19 is omitted from the study. Further trend analysis of the impact of school funding equity to include data from both before and after the COVID-19 pandemic would present more information about whether or not the pandemic impacted divisions' fiscal capacity or fiscal neutrality disproportionally.

Furthermore, the researcher would recommend that further research be conducted on the topic of adequacy as it relates to the years analyzed (or beyond). Adequacy, though not entirely exclusive from equity, places a more concerted focus on the outcomes rather than resource inputs. For the Commonwealth of Virginia, outcomes that may be considered for an adequacy study include cohort specific data such as SOL test scores, graduation rates, GED acquisition, dropout rates, or other data reported on a state-wide level. While this study measured for both horizontal and vertical equity, there are still groups who were not specifically identified by their classification (such as by race or gender). An adequacy study could take into account not only the necessary inputs for equitably educating students, but the adequate resources to fairly educate students of varying backgrounds and classifications across the entire Commonwealth of Virginia.

Summary

In this chapter, the findings and implications were presented and related to the two research questions of the study. Then, suggestions for future research were provided. This study provided a longitudinal analysis of both horizontal and vertical equity in the Commonwealth of Virginia over a fourteen-year period spanning from 2004-2018. Using trend analysis, the research suggested that horizontal and vertical equity have both decreased since FY2004. These results will help educational leaders and members of the General Assembly address the inequities in funding across divisions in the Commonwealth of Virginia, especially for divisions

with higher concentrations of categorical students (i.e., economically disadvantaged, special education, and English language learners).

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Appendix A

Courtney Van der Linden Training in Human Subjects Protection

Appendix B

Virginia Tech Institutional Review Board Non-Human Subject Determination

Division of Scholarly Integrity and Research Compliance
Institutional Review Board
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MEMORANDUM

DATE: February 3, 2020

TO: Carol S Cash

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires October 29, 2024)

PROTOCOL TITLE: An Historical Analysis of Fiscal Equity in the Commonwealth of Virginia: 2004-2018

IRB NUMBER: **20-106**

Based on the submitted project description and items listed in the Special Instructions section found on Page 2, the Virginia Tech IRB has determined that the proposed activity is not research involving human subjects as defined by HHS and FDA regulations.

Further review and approval by the Virginia Tech HRPP is not required because this is not human research. This determination applies only to the activities described in the submitted project description and does not apply should any changes be made. If changes are made you must immediately submit an Amendment to the HRPP for a new determination. Your amendment must include a description of the changes and you must upload all revised documents. At that time, the HRPP will review the submission activities to confirm the original "Not Human Subjects Research" decision or to advise if a new application must be made.

If there are additional undisclosed components that you feel merit a change in this initial determination, please contact our office for a consultation.

Please be aware that receiving a "Not Human Subjects Research" Determination is not the same as IRB review and approval of the activity. You are NOT to use IRB consent forms or templates for these activities. If you have any questions, please contact the Virginia Tech HRPP office at 540-231-3732 or irb@vt.edu.

PROTOCOL INFORMATION:

Determined As:	**Not Human Subjects Research**
Protocol Determination Date:	**February 3, 2020**

ASSOCIATED FUNDING:

The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.