THREE ESSAYS EXAMINING INCREASES IN STATE ELEMENTARY-SECONDARY EDUCATION SPENDING

By

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INTRODUCTION

State investments in public elementary-secondary education (i.e. pre-kindergarten through grade 12) have steadily increased over the past sixty years on average. On average, states contributed approximately $1,200 in revenues per pupil in 1960, $5,600 per pupil in 2000, and $6,900 per pupil in 2017.[1] Further, the share of total elementary-secondary education funding provided by state governments has also increased over time. In the 1920s, 83 percent of education funding came from local sources and the remaining 17 percent from state resources on average. By the 2017-18 school year, state governments provided 47 percent of education funding, local governments provided 45 percent, and the federal government provided 8 percent on average.[2] To facilitate greater understanding of such trends in state education spending over time, each of the studies in this dissertation examines a different aspect of increases in state spending on elementary-secondary education.

In the first study, I examine how state legislatures pay for increases in state education funding that result from school finance reforms [SFRs]. SFRs, as typically defined in the literature, are state-level reforms that result from a court ruling or legislative statue that lead to major redesigns of a state's school funding formula and/or increased state education funding for elementary and secondary public education. I specifically identify a sample of state SFRs that significantly increased elementary-secondary education spending for a sustained period of time. For each of the identified state SFRs, I then review the text of state legislative acts that were passed around the same time as (and often as a result of) the SFR for evidence of what changes

[1] Based on the authors own calculations. Longitudinal data on state elementary-education revenues was compiled from various sources; see Appendix A of Chapter 2 for further details.

[2] NCES (2020). *Revenues for public elementary and secondary schools, by source of funds: Selected years, 1919-20 through 2017-18*. Digest of Education Statistics. https://nces.ed.gov/programs/digest/d20/tables/dt20_235.10.asp

to the state budget were enacted to fund proposed increases in education spending. I verify this legislative evidence by quantitatively examining the effect of a state's SFR on the budget categories that were specified in legislation as being adjusted to fund increased education spending. This study is the first to examine how SFR-induced increases in elementary-secondary education spending are funded on a SFR-specific basis using a multi-step approach that draws upon evidence from multiple sources (both legislative acts and quantitative budgets data).

The second study investigates *state-specific* changes and trends in per pupil state education investments from 1960 to the present. Due to the challenges of collecting and compiling 50+ years of finance data across all fifty states, surprisingly little is known about changes and long-term trends in state elementary-secondary education spending among states. In order to examine state education investments over the last sixty years, I assisted with the collection and hand-entering of state revenues and student enrollment data from US Department of Education [DOE] and NCES series reports dating back to the early 1960's. I computed the overall level of change in per pupil state education spending between 1960 and 2017 by state. I also used a Bayesian algorithm to decompose each state education revenue time series to assess trends and changes in trends in state revenues over time.

In the third study, co-authored with Christopher Candelaria and Kenneth Shores, we examine why state elementary-secondary education funding has been rising. We specifically identify when distinct shifts or positive "changepoints" in state investments have occurred during the post-1990 adequacy era. We then conduct a wide search using multiple types of sources (e.g. websites, journal articles, books, published reports, and longitudinal state revenues data) to identify the key, state-level events that precede or coincide with the years at which positive changepoints in per pupil state education revenues occurred. We specifically focus on

documenting legislative activity, court activity, constitutional amendments, and resource shocks that were plausibly related to increases in state education funding. Following the search for events, we descriptively analyze the extent to which these four types of events preceded changepoints. We use these calculations along with illustrative examples of specific events to provide a description of the events motivating positive changepoints in state education funding.

CHAPTER 1

School Finance Reforms & State Finances: How Are Reform-Induced Increases in K-12 State Education Spending Funded?

Since 1989, 75 school finance reforms [SFRs] have occurred in 28 states. SFRs, as typically defined in the literature, are state-level reforms resulting from a court ruling or legislative statute that lead to major redesigns of a state's school funding formula and/or increased state education funding for elementary and secondary public education (i.e., pre-kindergarten through grade 12). SFRs have, on average, successfully increased the overall level of state spending on public schools, as well as targeted larger spending increases to districts serving economically disadvantaged students (Lafortune et al., 2018; Liscow, 2018; Shores et al., 2021). SFRs have been found to increase state education expenditures by approximately $500 per student in high-income districts and $1200 per student in low-income districts on average in real 2013 dollars (Lafortune et al., 2018).

As SFRs have lead many state governments to significantly increase their contributions to elementary-secondary education, questions arise regarding how state legislatures *pay for* such increases in education funding. Potential avenues for funding SFRs include increasing revenues by raising taxes, reducing expenditures on other state priorities (ex. welfare, corrections, higher education, etc.), or increasing state debt. Because states have differing political environments, funding priorities, and tax systems, the ways in which SFR-induced increases in education expenditures are funded likely varies across states. Understanding the breadth of options available for funding increased education expenditures is of interest to education policy-makers and state government officials, as finding funding is likely one of the largest barriers to raising education expenditures (and may explain why not all SFRs actually lead to increased education

funding, as found in Shores et al. (2021)). Further, understanding how SFR-induced increases in education spending are funded has broad societal implications and importance given that raising education expenditures can potentially result in an increased tax burden for citizens and corporations, reduced expenditures on other state priorities such as welfare or healthcare, or increased state debt.

To date, a handful of studies have examined how SFR-induced education spending increases are funded *on average* by estimating the effect of SFRs on state finances using national longitudinal finance data and difference-in-differences designs that leverage the differential timing of reform across states (Baicker & Gordon, 2006; Lafortune et al., 2018; Liscow, 2018; Murray et al., 1998).[3] Considered collectively, these studies all found that SFRs are *not* funded by reducing non-education state expenditures.[4] Liscow (2018), the only study to date that has examined the effects of SFRs specifically on state revenues, found that increases in education funding were financed on average by tax increases.

In this study, I seek to provide additional insights on how state legislatures pay for SFRs by a) examining how SFR-induced state education spending increases are funded on a SFR-specific basis and by b) leveraging a novel research design. Specifically, I first select a sample of state SFRs that significantly increased elementary-secondary education spending for a sustained period of time (i.e., at least three consecutive years in the first ten years post-reform). To do so, I use U.S. Census Bureau state-level finance data from fiscal years [FYs] 1987-2007, a list of court-ordered and legislative SFRs that occurred in 24 states between FYs 1989-2005,[5] and the

[3] To my knowledge, no state-specific case studies have examined how SFR-induced education spending increases are funded.
[4] Baicker and Gordon (2006) find no effect on non-education expenditures at the aggregate state level; however, they did find that every dollar increase in state *intergovernmental* education funding received by counties was offset by a 22-cent reduction in state intergovernmental funding of welfare, health, and transportation.
[5] As I discuss in the Data section of the paper, I draw from a list of court-ordered and legislative SFRs that was compiled by Shores et al. (2021). Appendix Table A1 lists all SFRs under consideration.

ridge augmented synthetic control method [ridge ASCM].[6] I find that seven out of 24 state SFRs significantly increased per capita state education expenditures at the $p < .10$ level for at least three consecutive years in the ten years following reform and thus are included in my selected analytic sample. My selected analytic sample includes the following seven state SFRs (FY of SFR listed in parentheses): Arkansas (1995), Kansas (1992), Maryland (1997), Michigan (1994), New Hampshire (1994), New Jersey (1990), and Vermont (1997).

For each of these seven state SFRs, I review the text of state legislative acts that were passed around the same time as (and often as a result of) the SFR for evidence of what changes to state finances were enacted (e.g., increasing state sales tax rates) to fund proposed increases in education spending. Given that state legislatures, *not* the court systems, are the government entity responsible for appropriating state funds, legislative statutes are the means through which increases in state education expenditures are enacted and subsequently funded. I then verify this legislative evidence by quantitatively examining the effect of a state's SFR on the revenues and/or expenditures that were specified in legislation as being adjusted to fund increased education spending. The idea is that if a state, for example, truly does fund increased education spending by increasing sales tax revenues, then there should be both legislative evidence that an increased sales tax rate was enacted *and* financial evidence that the state collected increased sales tax revenues. Similar to the analysis conducted to identify the selected analytic sample of state SFRs, I use U.S. Census Bureau finance data from 1982-2007 and the ridge augmented synthetic control method to examine the effect of a state's SFR on various state revenues and expenditures.

[6] The ridge augmented synthetic control method [ASCM], developed by Ben-Michael et al. (2020), is similar to the differences-in-differences (DID) or event study quasi-experimental designs, which compare the change in outcomes over time of a treated group to the change in outcomes over time of a weighted comparison group. However, ridge ASCM offers a more systematic way to assign weights to the comparison group than DID, which can result in the comparison group more closely resembling the treatment group and thus serving as a better counterfactual (Abadie et al., 2010). I discuss ridge ASCM in further detail in the Research Methods section of the paper and in Appendix B.

This study is the first to examine how SFR-induced increases in elementary-secondary education spending are funded on a SFR-specific basis, which in turn enables insights into the breadth of possibilities for funding SFRs. Understanding variability across states is also crucial to providing a more complete picture of how SFRs are funded given differences among state-level politics, economic conditions, and demographic contexts. This study is also the first to use a multi-step approach that draws upon evidence from multiple sources (both legislative acts and quantitative finance data) to determine how SFRs are funded, leading to further confidence in my findings.

The remainder of this paper is structured as follows. I first briefly review the history of SFRs and what is currently known about the effects of SFRs on education spending and state finances. Next, I describe the analytic approach employed, followed by the results of my analysis. Finally, I conclude with a discussion of my findings and suggestions for future research.

Background

School Finance Reforms

The history of SFRs is often divided into two periods: first, the "equity" era, followed by the "adequacy" era. The equity era began in the 1970s, when unequal education funding based on property taxes led citizens to file litigation against state governments in efforts to *equalize* funding. Equity cases were built on the belief that states were responsible for funding per pupil education spending equally across districts so that all children had an equal opportunity to succeed in the education system. Reforms during the equity era often resulted in increased state funding of education in districts with low property tax bases. However, by the mid- to late

1980's, suits based on equity arguments were becoming less successful (Candelaria & Shores, 2019; Corcoran & Evans, 2008; Lafortune et al., 2018; Liscow, 2018).

Since the late 1980s, SFRs have shifted to focusing on the *adequacy* of school funding to provide students, especially those from disadvantaged backgrounds, the ability to achieve some minimum threshold of academic proficiency. Reforms based on adequacy grounds can require increased education funding for all districts in a state, since all schools could be inadequately funded. In addition, adequacy reforms can target larger spending increases to districts serving economically disadvantaged students in order to compensate for the out-of-school inequalities that disadvantaged students face. The first SFR of the adequacy era was in response to the 1989 Kentucky case *Rose v. Council for Better Education*; the majority of SFRs that occurred post-1989 were also based on adequacy grounds. Between 1989 and 2011, 74 legislative and court-ordered SFRs occurred in 27 states.[7]

SFRs generally result in state education finance systems being overturned and school funding formulas being rewritten. However, it is important to note that most of these reforms do not specify how much school funding should be increased, and some states have experienced more than one SFR. Eighteen states have had multiple SFRs during the adequacy era alone. New Hampshire has had six SFRs and New Jersey has had seven SFRs between 1989 and 2011.

Effects of SFRs on Education Spending

Multiple studies have examined the effects of court-ordered and/or legislative SFRs on state education expenditures using quasi-experimental designs. In general, this literature has found that SFRs do increase state spending on education, on average (Candelaria & Shores, 2019; Card & Payne, 2002; Jackson et al., 2016; Lafortune et al., 2018; Liscow, 2018; Murray et

[7] See Appendix Table A1 for a list of SFRs that occurred between 1989 and 2011.

al., 1998; Shores et al., 2021). Jackson et al. (2016) examined the impact of court-ordered SFRs that occurred during the equity era between 1972 and 1990. They found that students in high-income districts who attended all twelve grades of primary and secondary schooling in the years following an SFR were exposed to a 6% increase in funding, while students in low-income districts were exposed to a 12% increase in funding. Lafortune et al. (2018) and Candelaria & Shores (2019) examined the effects of SFRs that occurred during the post-1990 adequacy era, with the former study including both legislative and court-ordered reforms and the latter study examining only court-ordered. Both studies used an event study design that relied on the variable timing of these reforms and found that SFRs lead to sustained increases in school spending, especially in low-income school districts. Seven years after reform, the highest poverty districts in reform states experienced an 11.5 to 12.1 percent increase in per-pupil spending (Candelaria & Shores, 2019). Examining court-ordered SFRs across both the adequacy and equity eras, Liscow (2018) found using an event study design that state education expenditures increased by an average of $912 per student following an SFR.

While SFRs increase state education expenditures on average, there is heterogeneity in the effects of SFRs across states. Shores et al. (2021) estimated the state-specific effects of court- and legislative-ordered SFRs that occurred between 1993 and 2012 using the ridge augmented synthetic control method. Their study found that, while SFRs increased spending in low-income districts in the aggregate, more than half of the states experienced a null or negative effect on education spending after an SFR. For example, Arizona was estimated to have reduced education expenditures in low-income districts by 16% following their reform. Such null and negative effects highlight the importance of determining whether an SFR actually increased education funding prior to investigating how an SFR was funded.

Effects of SFRs on State Finances

As described above, SFRs lead to significant increases in state educational expenditures on average. Studies estimate that per-pupil education expenditures typically increase by $700 to $900 per student after an SFR (Liscow, 2018), which is a rather large increase to result from a single reform. A handful of studies have examined how state legislatures *pay for* these SFR-induced increases in education spending. Four studies have examined the effects of SFRs on non-education state expenditures (Baicker & Gordon, 2006; Lafortune et al., 2018; Liscow, 2018; Murray et al., 1998), with Liscow (2018) also examining the effects of SFRs on revenues. All four studies used data from the U.S. Census Bureau's Annual Survey of State Government Finances and an event study design that exploits the exogeneity of reform timing. However, the time frame and type of SFR events included differed across studies. Murray et al. (1998) examined court-ordered SFRs that occurred in 11 states between 1971 and 1992; Baicker and Gordon (2006) examined court-ordered SFRs that occurred in 22 states between 1971 and 1997; Liscow (2018) examined court-ordered SFRs that occurred in 25 states between 1971 and 2013; and Lafortune et al. (2018) examined legislative and court-ordered SFRs that occurred in 26 states between 1990 and 2011.

Across all four studies, SFRs were found to have no effect on non-education expenditures at the aggregate state level (Baicker and Gordon (2006), pg. 1533; Lafortune et al. (2018), pg. xxvii of appendix; Liscow (2018), pg. 20-21; Murray et al. (1988), pg. 805-807), though Baicker and Gordon (2006) found that increases in intergovernmental state education funding to counties was offset by reduced state aid to counties for health and hospitals, highways, and public welfare. Building on this finding, Liscow (2018) found that increases in education expenditures resulting from SFRs were primarily paid for through tax increases. Specifically, Liscow (2018)

estimated that SFRs lead to a $152 per capita increase in state education expenditures and a nearly equivalent increase of $150 per capita in taxes.

Data

I use five sources of data throughout the analysis. First, I use the Annual Survey of State Government Finances to obtain data on state revenues, expenditures, and debt. The survey is collected by the U.S. Census Bureau and has been compiled into a panel dataset, the Government Finance Database, by Pierson et al. (2015). Revenues and expenditure data is generally available for fiscal years [FYs] 1972 and 1977-2017. My analytic sample draws upon data from FYs 1982 (the first year that measures of elementary-secondary education expenditures are available for all 50 states) through 2007. Because the Great Recession, which began in December 2007, substantially altered (and in some cases, continues to alter) state revenues and expenditures (Rosewicz, 2019), I elect to examine the effects of SFRs on state finances only through FY 2007 (the last fiscal year prior to the Great Recession).

Second, I use a dataset on local property tax revenues to understand how shifts in local property tax collections were related to funding SFRs.[8] These data come from the Local Education Agency Finance Survey (F-33), which is collected by the U.S. Census Bureau and audited and distributed by the National Center for Education Statistics [NCES]. These data were also compiled into a panel dataset spanning FYs 1987 through 2007.[9] I aggregate the local

[8] When reviewing the text of state legislative acts to determine how SFR-induced increases in education spending were funded, it became apparent that changes to state and local property tax revenues played a key role in funding SFRs in many of the states included in my analytic sample. As such, I obtained local property tax revenues data in order to quantitatively examine the effect of a given state's SFR on locally-collected property tax revenues.
[9] During fiscal years 1987, 1988, 1989, 1991, 1993, and 1994, the full universe of school districts was not surveyed, and these years are not included in the NCES release of data; however, we were able to obtain district-level data from sampled districts directly from the U.S. Census Bureau.

property tax revenue data, which is collected at the district-level, up to the state-level in order to examine the effect of a given SFR on statewide local property collections.

Third, I merge in state population data collected by the U.S. Census Bureau to create annual measures of each state's population between 1982 and 2007.[10,11] Fourth, I also use data on state student enrollments (in pre-K through grade 12) from an annual panel spanning the years 1982 to 2007. For years post-1986, enrollment data were obtained from the National Public Education Financial Survey [NPEFS], which is distributed by NCES. Enrollment data prior to 1987 were obtained from U.S. Department of Education [DOE] and NCES series reports, including *Digest of Education Statistics* and *Statistics of State School Systems,* by Paglayan (2019). In my analyses, all fiscal variables (besides local and total property tax revenues[12]) are presented in per-capita terms by dividing by total state population in the relevant year. I measure in per-capita terms, rather than the per-pupil terms often used in the education literature, because I am examining state expenditures and revenues which are financed by the general population, not pupils. State elementary-secondary education expenditures are also presented in per-pupil terms by dividing by state student enrollment, as is typically done in the education literature. All nominal dollar values are transformed into 2007 USD using the *cpiget* Stata command (Shores & Candelaria, 2019).[13]

[10] The annual state population data estimates the population on July 1 of that calendar year (e.g., population data in 1989 refers to the estimated population on July 1, 1989). However, the year of the state revenue and expenditure data corresponds to fiscal years typically starting on the preceding July 1 and ending on June 30 (e.g., fiscal year 1989 typically starts on July 1, 1988 and ends on June 30, 1989). In order to align the two types of data, I convert the state population data to fiscal years by adding a value of 1 to the calendar year (e.g., so after conversion, population data in fiscal year 1989 refers to the estimated population on July 1, 1988).

[11] The state population data was specifically obtained from the following U.S. Census website: https://www2.census.gov/programs-surveys/popest/tables/

[12] Local and total (i.e., state + local) property tax revenues are scaled by student enrollment, not population, due to the US Census Bureau data not including a measure of population associated with local (i.e., school district) boundaries.

[13] This command converts nominal to real dollars using an annual average of monthly CPI data over the state-specific fiscal-year time span.

Lastly, to identify states that have an experienced a SFR, I draw from a list of court-ordered and legislative SFRs that was compiled by Shores et al. (2021). Their list includes SFRs that occurred during the adequacy era between academic years 1989 and 2011, which aligns well with the years in which state finance data is available (FYs 1982-2007). For my analysis, I include SFRs that occurred from FY 1989 up to FY 2005 in order to have at least two years of state finance data following an SFR.[14] I convert the dates associated with the SFRs, which Shores et al. (2021) provide in both calendar and academic school years, to fiscal years aligned with the reporting of the revenue and expenditure data. For more detailed information on the conversion process, see Appendix A1. Appendix Table A1 lists the SFRs under consideration. 63 SFR events occurred in 24 states between FYs 1989 and 2005. Twenty-six states did not have a reform during this time period. Kentucky was the first state to have a SFR reform in the adequacy era in FY 1990, whereas New York did not have its first SFR reform of the adequacy era until FY 2004. The first year a state's funding system was overturned in the adequacy era by an SFR reform is considered the start of treatment.

Selected Analytic Sample of State SFRs

In this study, I am interested in examining how state SFRs *that increase state education spending* are funded. As such, I select an analytic sample of state SFRs that significantly increased per capita state expenditures on public elementary-secondary education at the $p < .10$

[14] In addition to the SFRs identified by Shores et al. (2021), I also include Michigan's 1994 passage of Proposal A as a legislative SFR. Shores et al. (2021) did not consider Proposal A to be an SFR because it was a constitutional amendment approved of by state voters (ref. footnote 8). However, Proposal A was originally drafted and referred to voters by the state legislature (and thus is considered a *legislatively-referred* constitutional amendment). Because the legislature was responsible for initiating Proposal A, I consider Proposal A to fall within the definition of a legislative SFR and thus include it in my list of court-ordered and legislative SFRs that occurred between FYs 1989-2005.

level for at least three consecutive years in the ten years following reform.[15] This selection was made for the following reasons. First, requiring that per capita education expenditures increase following an SFR demonstrates that state elementary-secondary education spending was actually impacted by reform (as mentioned in the introduction, not all SFRs result in increased state education funding; see Shores et al., 2021). Second, requiring that education expenditures increase for at least three consecutive years following an SFR lends further evidence that education spending increased for a sustained period of time and that the significant effect estimates are not the result of Type 1 error (given that I am estimating effects for 10 years post-SFR, it is fairly likely that one effect estimate will be statistically significant by chance). Lastly, I examine effects up through ten years post-reform in order to allow sufficient time for state legislatures to alter both education expenditures and other state revenues and/or expenditures in response to an SFR.

In order to determine which state SFRs meet the criteria discussed above, I separately estimate for each of the 24 states that experienced an SFR between FYs 1989 and 2005 the effect of the state SFR on per capita state education expenditures. To estimate these models, I use the ridge augmented synthetic control method (which is subsequently described in the research methods section of the paper and discussed in-depth in Appendix B). Standard errors are based on a row-based jackknife to allow for autocorrelation within states (Ben-Michael et al., 2019). I find that seven out of 24 state SFRs significantly increased per capita state education expenditures at the $p < .10$ level for at least three consecutive years in the ten years following

[15] State expenditures on public elementary-secondary education is operationalized as the sum of direct and intergovernmental expenditures on elementary and secondary education (pre-K through grade 12). Direct expenditures include current expenditures (e.g., salaries, supplies, etc.), purchase of capital improvements, and construction expenditures. Intergovernmental expenditures are amounts paid to other governments for performance of specific functions or for general financial support. State elementary-secondary education expenditures also includes all expenditures for public charter schools offering elementary-secondary education.

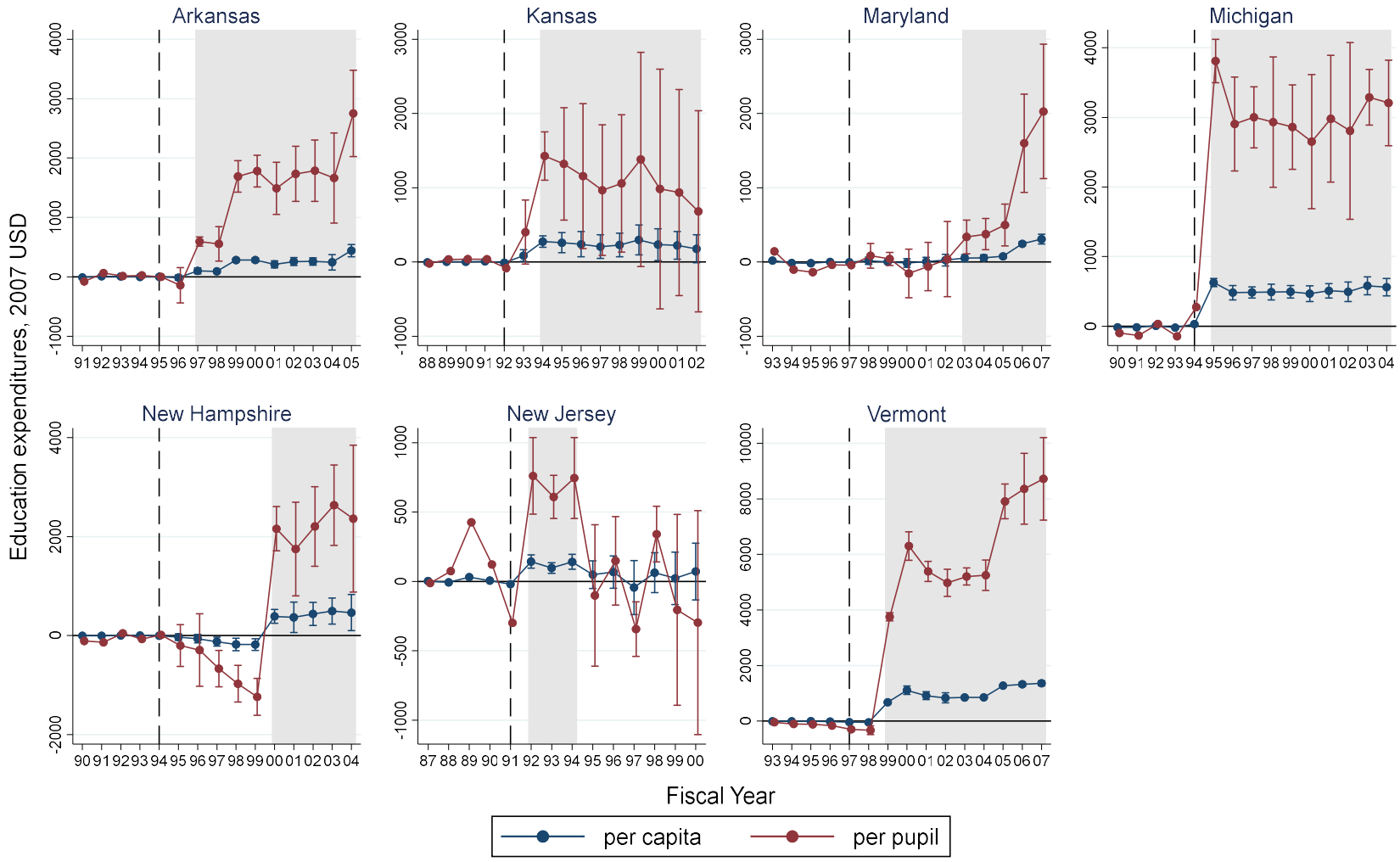
reform and thus are included in my selected analytic sample. I display the ridge ASCM effect estimates of SFRs on per capita, as well as per pupil, elementary-secondary education expenditures for these seven state SFRs graphically in Figure 1 (displayed on the next page).[16]

The seven state SFRs include Vermont's *Brigham v. State* (FY 1997); Michigan's Proposal A (FY 1994); New Hampshire's *Claremont School District v. Governor* [*Claremont I*] (FY 1994); Kansas' School District Finance and Quality Performance Act (FY 1992); Arkansas' *Lake View v. Huckabee* and the Equitable School Finance System Act (Act 917) (FY 1995); Maryland's *Bradford v. Maryland State Board of Education* (FY 1997); and New Jersey's *Abbott v. Burke II* & the Quality Education Act (FY 1991).

As Table 1 shows, there is variation in the timing of SFRs and in their effects on state education spending. The fiscal year of the seven SFR reforms ranged from 1990 (New Jersey) to 1997 (Maryland and Vermont). Further, the total number of years following an SFR reform in which both per capita and per pupil state education spending significantly increased varies from three (New Jersey) to 10 years (Michigan). Lastly, the weighted average effect of a state SFR reform on state education spending ranges from a high of $980 per capita ($5,253 per pupil) in Vermont to a low of $124 per capita ($684 higher per pupil) in New Jersey.

[16] Figure C1 in Appendix C displays ridge ASCM effect estimates of SFRs on per capita and per pupil elementary-secondary education expenditures for all 24 states that experienced an SFR between FY 1989 and 2005.

Figure 1. Ridge ASCM effect estimates of SFRs on per capita and per pupil elementary-secondary education expenditures



Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Circular markers represent effect estimates and spikes represent 90% confidence intervals. The vertical dashed line denotes the fiscal year of the SFR reform. Grey background shading indicate years in which per capita education expenditures significantly increased at the $p < .10$ level.

Table 1. Selected analytic sample of state SFRs

State SFR	Fiscal year of SFR	Fiscal years (total number of years) following SFR reform in which per capita state education spending significantly increased at the p <.10 level	Weighted average effect of SFR on state education spending	
			Per capita	Per pupil
Vermont, Brigham v. State	1997	1999-2007 (9 years)	$980	$5,253
Michigan, Proposal A	1994	1995-2004 (10 years)	$525	$3,160
New Hampshire, Claremont School District v. Governor [Claremont I]	1994	2000-2004 (5 years)	$425	$2,213
Kansas, School District Finance and Quality Performance Act	1992	1994-2002 (9 years)	$242	$1,251
Arkansas, *Lake View v. Huckabee* and the Equitable School Finance System Act (Act 917)	1995	1997-2005 (9 years)	$217	$1,181
Maryland, *Bradford v. Maryland State Board of Education*	1997	2003-2007 (5 years)	$137	$633
New Jersey, *Abbott v. Burke II* & the Quality Education Act	1991	1992-1994 (3 years)	$124	$684

Notes: State SFRs that significantly increased (at the p < .10 level) per capita state education expenditures for at least three consecutive years in the ten years following reform are included in the analytic sample. The weighted average effect of an SFR on state education spending (last two columns of table) is weighted by the precision of the estimate and is calculated across the fiscal years in which per capita state education spending significantly increased at the p <.10 level (third column in table). Real dollar values are presented in 2007 USD.

Research Methods

To determine how SFR-induced increases in education spending are funded, I use a two-step approach. First, I review the text of state legislative acts that were passed around the same time as (and often as a result of) the seven state SFRs for information on what changes to state finances were made in order to fund proposed increases in education spending. Second, I quantitatively examine using the ridge augmented synthetic control method the effect of a given state's SFR on the state revenues and/or expenditures that were specified in legislation as being adjusted to fund increased education spending. All ridge ASCM models are estimated using R's *augsynth* command (Ben-Michael, 2020). Standard errors are based on a row-based jackknife to allow for autocorrelation within states (Ben-Michael et al., 2019). This second step provides an important check on whether the state legislature "followed through" and adjusted state (and in some cases, local) finances in the ways specified in the referenced legislation to fund SFRs. Ultimately, this approach combines evidence regarding how SFRs are funded from multiple sources (both legislative acts and finance data), leading to further confidence in my results.

In what follows, I describe the process of identifying and reviewing state legislative acts in further detail. I also provide an intuitive overview of the ridge augmented synthetic control method [ridge ASCM], developed by Ben-Michael, Feller, and Rothstein (2020), which was used to estimate the causal effect of SFRs on state and local finances. This overview, which describes various approaches to estimating state-specific individual effect sizes, is modeled after the work of Shores et al. (2021) who first used a case study approach to compare SCM and ridge ASCM to other estimation strategies. A technical description of ridge ASCM using formal notation can be found in Appendix B. Additionally, the results of robustness checks used to evaluate the quality and validity of the ridge ASCM estimates are available in Appendix C.

Identifying & Reviewing State Legislative Acts

Four of the seven state SFRs included in my selected analytic sample resulted directly from the passage of a legislative statute (which, in turn, may have been prompted by a court ruling) or a legislatively-referred constitutional amendment: Michigan's 1994 SFR was prompted by Proposal A (a legislatively-referred constitutional amendment); Kansas' 1992 SFR by the School District Finance and Quality Performance Act; Arkansas' 1995 SFR by the Equitable School Finance System Act (and *Lake View v. Huckabee)*; and New Jersey's 1991 SFR by the Quality Education Act (and *Abbott v. Burke II)*. The three remaining SFRs included in my analytic sample were court-ordered: Vermont's 1997 SFR was preceded by *Brigham v. State* (1997); New Hampshire's 1994 SFR by *Claremont School District v. Governor [Claremont I]* (1994), and Maryland's 1997 SFR by *Bradford v. Maryland State Board of Education* (1996). While the list of SFRs that my selected analytic sample is drawn from did not note any legislative statutes as being passed subsequent to these three SFRs, some kind of legislative activity had to have occurred in order for education expenditures to have increased following the SFR. This is because the state legislature, *not* the court system, is the government institution responsible for increasing or decreasing state education funding via passing bills or acts, ratifying new laws, and referring referenda. As such, in the case of these three court-ordered SFRs, I searched for and subsequently found legislative statutes related to increasing state education expenditures that were passed in the years following (and often directly as a result of) the aforementioned court orders.[17]

[17] Specifically, I found that the Vermont legislature passed the Equal Educational Opportunity Act (Act 60) following the *Brigham v. State* court ruling. The New Hampshire legislature passed House Bill (HB) 117 in the years following *Claremont I.* Maryland's legislature passed the Bridge to Excellence in Public Schools Act (Senate Bill 856) following *Bradford v. Maryland State Board of Education.* Additional details regarding each of these legislative statutes and how they lead to increased state education funding in their respective states are provided in the results section.

After identifying the legislative activity that was associated with each SFR, I obtained and reviewed the text of these legislative statutes and amendments for evidence of what changes to state finances were made in order to fund increases in education spending. I also reviewed any secondary sources (i.e., academic journal articles, news articles, published briefs or reports) I found with relevant information on how state legislatures funded SFRs.

Estimating State-Specific Effect Sizes: An Intuitive Comparison of Ridge ASCM to Other Estimation Strategies

This study uses ridge ASCM both to identify the analytic sample of state SFRs that significantly increased per capita state elementary-secondary education spending, as well as to investigate how these SFRs are funded by estimating effects on state and local finances. To build intuition regarding ridge ASCM, consider estimating the effect of one state SFR, New Hampshire's 1994 SFR, on per capita state education spending. Using the potential outcomes framework (Rubin, 1974), we can define individual effect sizes as $\gamma_t = Y_t(1) - Y_t(0)$, where γ_t represents the treatment effect estimate for New Hampshire in year *t*. $Y_t(1)$ represents the potential education expenditures under the assumption of having an SFR in New Hampshire in year *t* and $Y_t(0)$ represents the potential education expenditures under the assumption of not having an SFR in New Hampshire in year *t.* However, we cannot observe $Y_t(0)$; meaning, we cannot observe what education expenditures would have been in New Hampshire if it had not experienced an SFR. This issue of observing $Y_t(1)$ but not $Y_t(0)$ is often referred to as the "fundamental problem of causal inference" (Rubin, 1974).

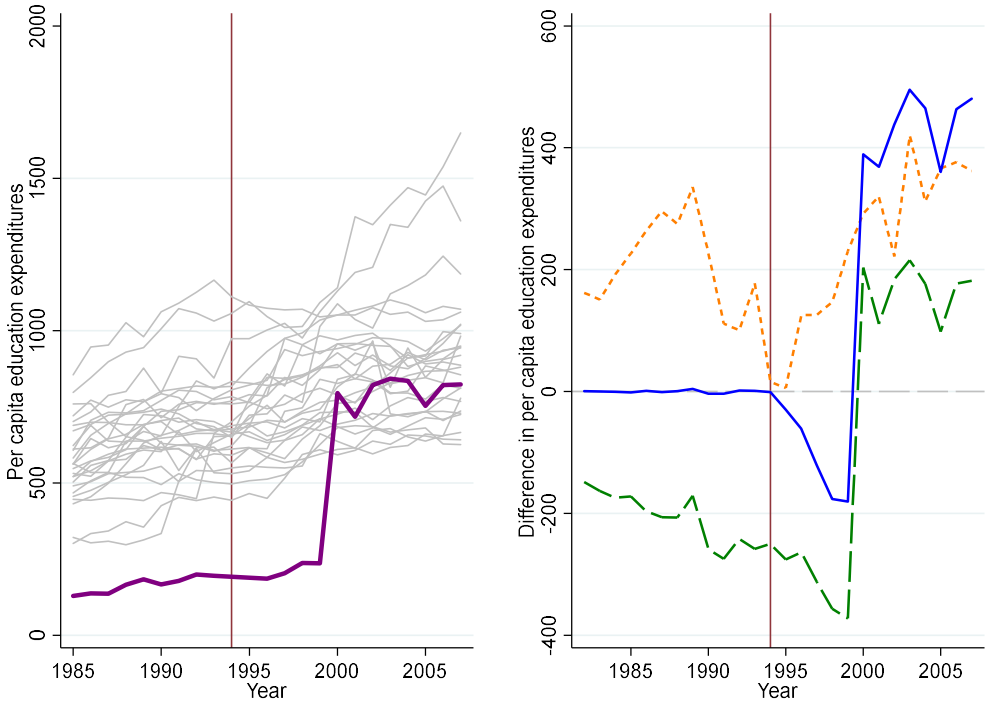
Although $Y_t(0)$ is not observed, I can estimate $Y_t(0)$ using the outcomes of non-treated states. Specifically, I can leverage the education expenditures of states that didn't experience an SFR to construct a comparison group for New Hampshire in three ways: (1) compute the mean

education expenditures of non-treated states, weighting each non-treated state equally (referred to as "equal-weight average"); (2) compute a synthetic control mean of education expenditures in non-treated states through assigning time-invariant weights of differing values to non-treated states based on their pre-treatment match (referred to as "traditional SCM"); (3) compute a de-biased synthetic control mean of education expenditures in non-treated states through adding a bias correction term to the synthetic control mean calculated in (2) above (referred to as "ridge ASCM").

The left panel of Figure 2 below displays per capita education expenditures over time in real 2007 USD for New Hampshire and all non-treated states. The purple line represents New Hampshire's per capita education expenditures over time, and the grey lines represent per capita education expenditures over time in non-treated control states. The vertical red line denotes the timing of New Hampshire's 1994 SFR. When we compare New Hampshire's per capita education expenditures before and after its SFR, we see that per capita education expenditures were higher on average after the SFR. However, per capita education expenditures were also generally higher in non-treated states in the years following 1994 compared to the years prior, suggesting that all states may have been experiencing an upward trend in per capita education expenditures regardless of whether they had an SFR or not.

The right panel of Figure 2 displays dynamic effect estimates of New Hampshire's 1994 SFR on per capita education expenditures using three different comparison groups. The short-dashed orange line represents differences between New Hampshire's per capita education expenditures and mean education expenditures of non-treated states, where each non-treated state is weighted equally (referred to as "equal-weight average"). The long-dashed green line represents differences between New Hampshire's per capita education expenditures and a

Figure 2. Estimating state-specific effects using ridge ASCM and other estimation strategies



Notes: The left panel displays per capita state elementary-secondary education expenditures in real 2007 USD over time. The purple line represents New Hampshire's per capita state education expenditures over time, and the grey lines represent per capita state education expenditures over time in non-treated control states. The vertical red line denotes the timing of New Hampshire's 1994 SFR. The right panel displays dynamic treatment effect estimates of New Hampshire's SFR on per capita education expenditures using three different comparison groups. The short-dashed orange line represents differences between New Hampshire's per capita education expenditures and mean education expenditures of non-treated states, where each non-treated state is weighted equally (referred to as "equal-weight average"). The long-dashed green line represents differences between New Hampshire's per capita education expenditures and a synthetic control mean of education expenditures, where the synthetic control mean is calculated through assigning time-invariant weights of differing values to non-treated states based on their pre-treatment match (referred to as "traditional SCM"). The blue line represents differences between New Hampshire's per capita education expenditures and a de-biased synthetic control mean of education expenditures, where the de-biased synthetic control mean is calculated through adding a bias correction term to the traditional synthetic control mean (referred to as "ridge ASCM").

synthetic control mean of education expenditures, where the synthetic control mean is calculated through assigning time-invariant weights of differing values to non-treated states based on their pre-treatment match (referred to as "traditional SCM"). The blue line represents differences between New Hampshire's per capita education expenditures and a de-biased synthetic control mean of education expenditures, where the de-biased synthetic control mean is calculated

through adding a bias correction term to the traditional synthetic control mean (referred to as "ridge ASCM").

If the comparison group adequately mirrors the pre-SFR spending levels and trend of New Hampshire, then the difference in per capita education expenditures between the comparison group and New Hampshire should be approximately zero. As shown in Figure 2, only the ridge ASCM comparison group (blue line) consistently results in a difference of zero in the pre-treatment period, suggesting that the equal-weight average and traditional SCM comparison groups do not serve as good counterfactuals to New Hampshire. In turn, use of the ridge ASCM comparison group provides differing estimates of the effect of New Hampshire's SFR on per capita education expenditures compared to the other two approaches. This case study highlights the differences in both pre-treatment match quality and individual effect estimates obtained when using differing approaches to construct comparison groups.[18]

Results

The results section is structured as follows. For each of the seven state SFRs included in my analytic sample, I first provide a brief description of the SFR and the extent to which state education expenditures were increased following the SFR. I then detail how each state funded such increases in state expenditures. I begin with Vermont's 1997 SFR, which had the largest average effect on state education funding of the seven state SFRs, and continue in descending order based on the SFR's average effect on education funding.

[18] Figure C2 in Appendix C displays, for all 24 states that experienced an SFR between FYs 1989 and 2005, the percent improvement in pre-treatment model fit obtained from the per capita and per pupil elementary-secondary expenditures ridge ASCM models relative to models that use equal or traditional SCM weights.

Vermont: *Brigham v. State* (FY 1997)

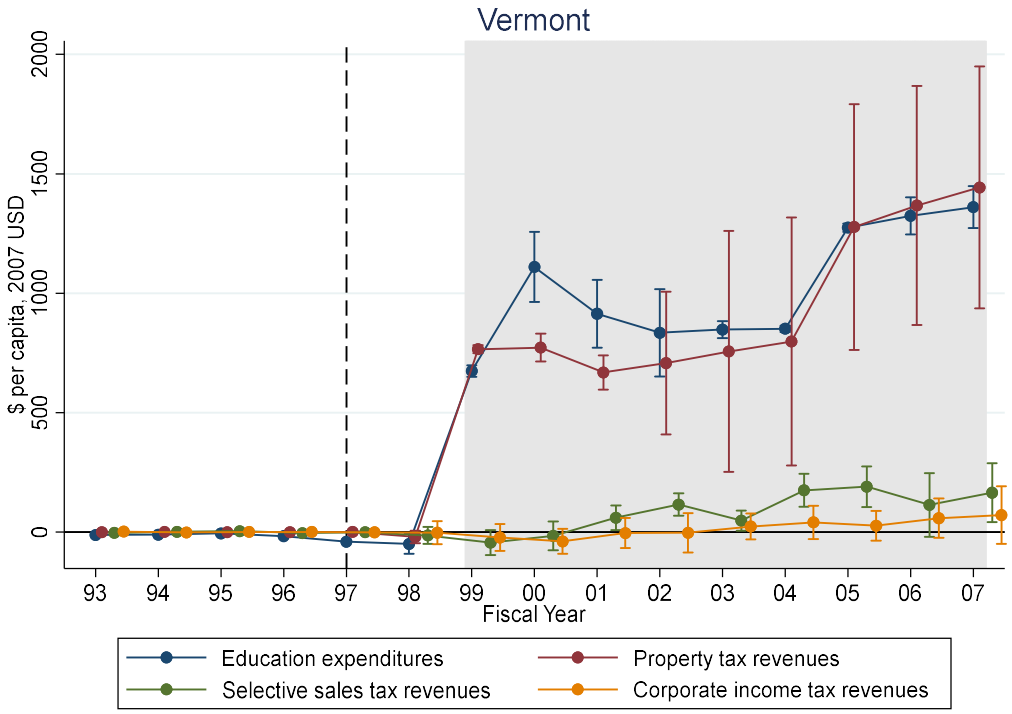
In February 1997, the Vermont Supreme Court ruled in *Brigham v. State* (1997) that the state's funding system was unconstitutional and directed the Legislature to create a system that would enable "substantially equal opportunity". In June of that same year, lawmakers enacted the Equal Educational Opportunity Act, more commonly known as Act 60. Under Act 60, which went into effect in FY 1999, the legislature enabled greater equality of education funding through distributing education funds using a foundation grant program.[19] Foundation programs guarantee a base level of funding per pupil. The state also presumed the primary responsibility for funding the foundation grant program and state contributions to elementary-secondary education increased as a result. Per capita state education expenditures were approximately $980 higher on average in the nine years following Act 60's enactment (FYs 1999-2007) compared to the state's synthetic counterfactual (see Figure 3).

The Vermont legislature increased state education funding under Act 60 primarily through exerting increased control over property taxes. Specifically, the state replaced district-controlled local property taxes with a state-controlled state property tax. As a result, per capita state property tax revenues increased by approximately $790 on average (per pupil property tax revenues increased by $5750 on average) relative to Vermont's synthetic control group in the year's following Act 60's passage (FYs 1999-2007; see Figure 4). In contrast, local property tax revenues decreased over the same time period (per pupil property tax revenues decreased by $4400 on average).[20] Act 60 also raised additional state education funding through mandating

[19] Districts could also opt to provide additional funding above the foundation grant by levying a local-share property tax. Funds raised from the local-share property tax were distributed using a power equalization formula (same cite as above). Power equalization plans guarantee that districts that approve the same tax rate receive the same amount of funding per pupil, regardless of local district property wealth, through redistribution.

[20] Total (local + state) property tax revenues remained largely unchanged following Act 60's passage.

Figure 3. Ridge ASCM effect estimates of Vermont's 1997 SFR on state revenues and expenditures

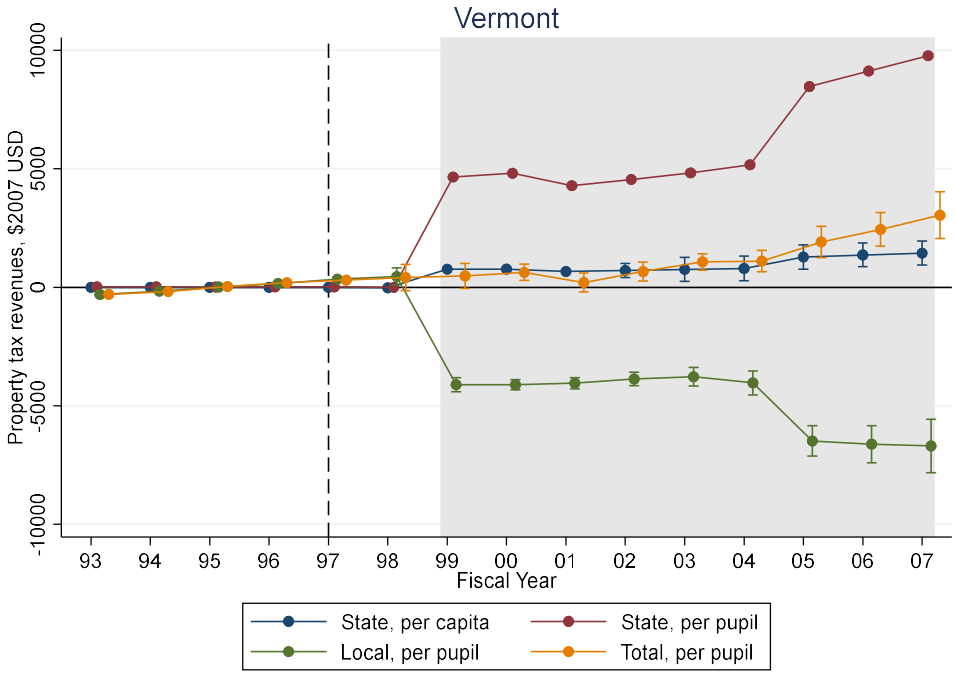


Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Circular markers represent effect estimates and spikes represent 90% confidence intervals (spikes may not visible if the standard errors, on which the spikes are based, are relatively small in magnitude). The vertical dashed line denotes the fiscal year of the SFR reform. Grey shading denotes years in which per capita state education expenditures significantly increased at the $p < .10$ level.

small increases to a variety of taxes, including the rooms and meals sales tax (2 percentage point increase), motor fuels sales tax (4 cent increase), purchase and use tax on motor vehicles (1 percentage point increase), sales tax on telecommunication services (imposing a 4.36% tax), corporate income tax (1.5 percentage point increase), and bank franchise tax and brokerage fees. Corporate income tax revenues and selective sales tax revenues (which encompass many of the tax increases mentioned above) increased post-1997, though these effects are not consistently significant (see Figure 3). Act 60 also specified that lottery revenues be used solely for funding

elementary-secondary public education. Lottery revenues were to be placed in the education fund, rather than the general fund, as a result.[21]

Figure 4. Ridge ASCM effect estimates of Vermont's 1997 SFR on property tax revenues



Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Circular markers represent effect estimates and spikes represent 90% confidence intervals (spikes may not visible if the standard errors, on which the spikes are based, are relatively small in magnitude). The vertical dashed line denotes the fiscal year of the SFR reform. Grey shading denotes years in which per capita state education expenditures significantly increased at the $p < .10$ level. Total per pupil property tax revenues are the sum of per pupil local and state property tax revenues. Local and total property tax revenues are scaled by student enrollment, not population, due to the US Census Bureau data not including a measure of population associated with local (i.e., school district) boundaries.

Michigan: Proposal A (FY 1994)

In 1993, the Michigan state legislature and Governor eliminated local property taxes as a source of funding for education, which state politicians and citizens had been attempting to do

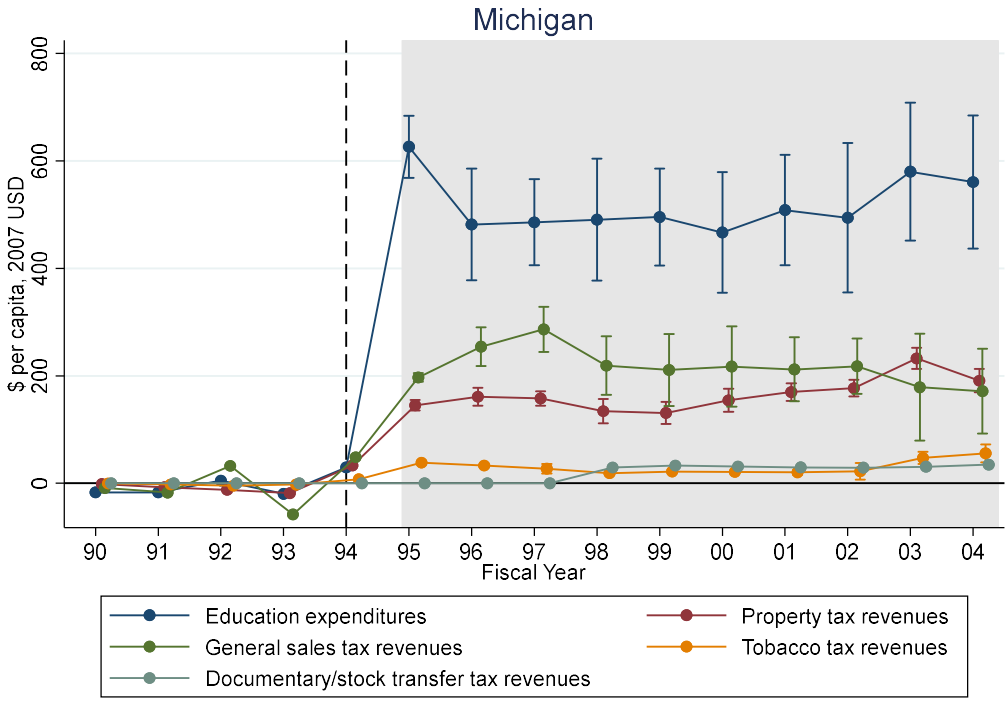
[21] Vermont's lottery revenues were only about $50 per capita on average between 1999-2007. Thus, diverting lottery funds from the general fund to the education fund likely had negligible effects on funding for other state priorities (ex. welfare, corrections, higher education, etc). I also don't find quantitative evidence that non-education state expenditures decreased post-1997 in Vermont.

since the early 1970's (Courant & Loeb, 1997). In order to fund education moving forward, the legislature proposed and voters subsequently approved a constitutional amendment, Proposal A, in FY 1994.[22] As depicted in Figure 5, per capita education spending was $525 higher, on average, in Michigan post-1994 compared to its synthetic counterfactual.

Proposal A led to increased state education expenditures by altering Article 9: Finance and Taxation of the Michigan state constitution and changing the tax systems that raised revenues for schools. Specifically, Proposal A required that the sales and use tax be raised by two percentage points and that a new state property tax of 6 mills be enacted. As a result, Michigan's state general sales tax revenues were about $202 higher per capita in Michigan post-1994, while state property tax revenues were approximately $169 higher per capita ($842 higher per pupil; see Figure 6). Proposal A also set limits on the minimum and maximum property tax rates that could be imposed locally. As a result, local property tax rates and revenues declined on average (by $3600 per pupil), as well as total (state + local) property tax rates and revenues (by $2600 per pupil; see Figure 6). Thus, Proposal A ultimately resulted in property tax relief for Michigan citizens. Proposal A also increased the cigarette tax by 50 cents per pack and the real estate transfer tax increased by 0.45 percentage points, leading to small increases in state tobacco tax and documentary/stock tax revenues ($30 and $12 per capita on average, respectively; see Figure 5).[23] All revenues generated from the Proposal A tax increases were earmarked for the state School Aid Fund and then distributed by the state to school districts based on a foundation grant formula (Courant & Loeb, 1997).[24]

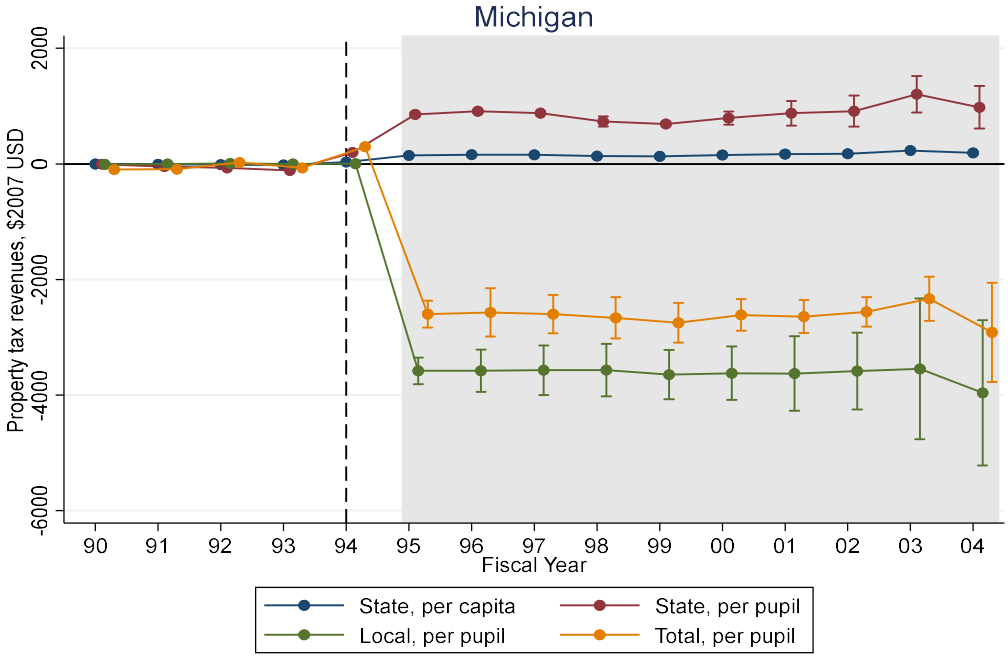
[22] Proposal A is more formally referred to as the Michigan Tax Amendment, Proposal A (1994).
[23] Documentary/stock tax revenues includes real estate transfer tax revenues. The Census Bureau does not provide a separate measure of real estate transfer tax revenues.
[24] Districts that raised more than the base foundation grant with the required local property tax rate were not required to return the excess revenue to the state, though the state did cap revenues in previously high-spending districts based on 1994 revenue levels (Cullen & Loeb, 2004). Certain high-wealth districts were also able to raise additional funding above the foundation grant via hold harmless mills.

Figure 5. Ridge ASCM effect estimates of Michigan's 1994 SFR on state revenues and expenditures



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

Figure 6. Ridge ASCM effect estimates of Michigan's 1994 SFR on property tax revenues



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

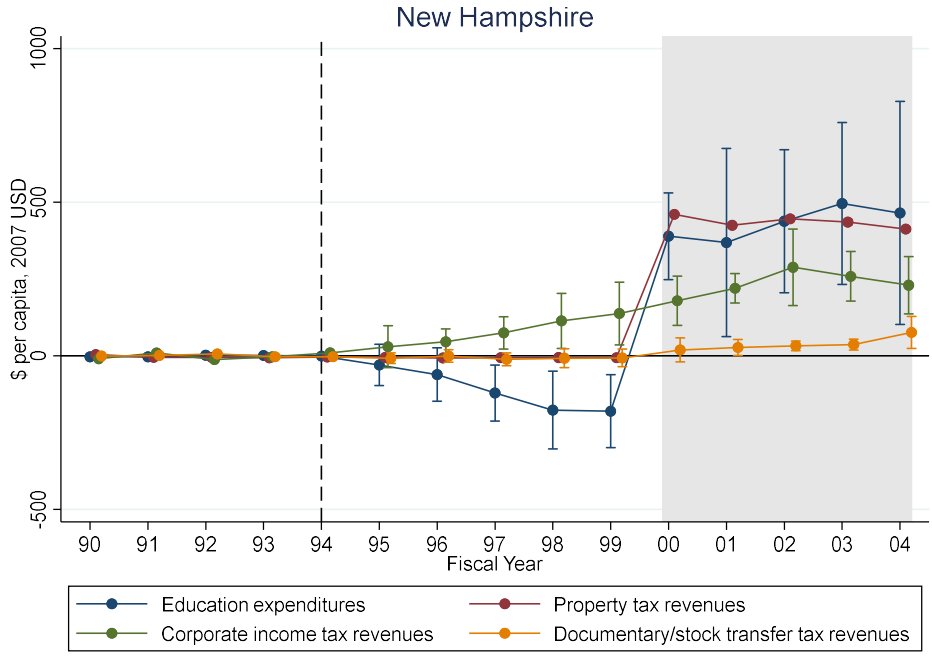
New Hampshire: *Claremont School District v. Governor* [Claremont I] (FY 1994)

In FY 1994, the New Hampshire Trial Court ruled in *Claremont School District v. Governor [Claremont I]* (1994) that the state has a constitutional duty to provide each child with an adequate education. Three years later, in December of 1997, the New Hampshire Supreme Court further declared in *Claremont II* (*Claremont v. Governor*, 1997) that the state education finance system was unconstitutional because it enabled inequitable local property tax rates and fostered inadequate educational opportunities. The court ordered that the state needed to define and fund an adequate education. In response to the *Claremont* rulings, the state legislature eventually passed House Bill (HB) 117 in April 1999 after several failed reform plans. HB 117 established a foundation grant program for distributing education funding. In the five years following HB 117's passage [FYs 2000-2004], New Hampshire's per capita state education funding increased by $425, on average, relative to its synthetic counterfactual (see Figure 7).

HB 117 enabled increased state education funding by replacing district-controlled local property taxes with a state-controlled state property tax.[25] As shown in Figure 8, per capita state property tax revenues increased by approximately $436 on average (per pupil property tax revenues increased by $2705 on average) relative to New Hampshire's synthetic control group after HB 117's enactment (FYs 2000-2004). In contrast, local property tax revenues decreased over the same time period (per pupil property tax revenues decreased by $3225 on average).[26] HB 117 also increased funding for education by mandating smaller increases to a variety of state taxes, including raising the business enterprise and business profits tax, raising the real estate transfer tax, expanding the rooms and meals sales tax, and instituting a statewide property tax on

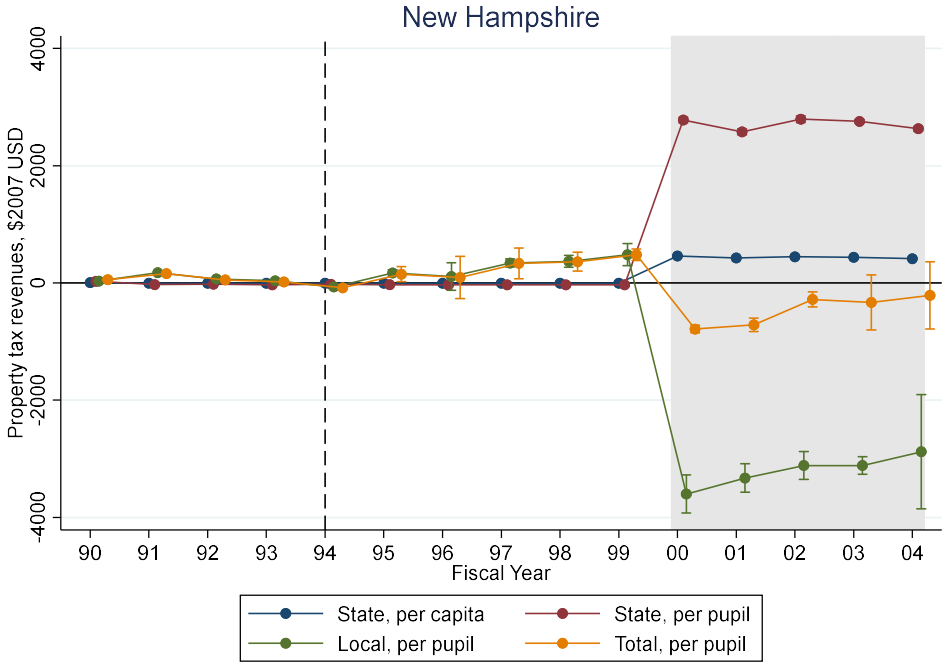
[25] School districts were required to give excess property revenue to the state government if their state property tax revenue was greater than the base foundation grant. School districts were also allowed to spend more than the base foundation grant by levying additional local property taxes (Lutz, 2010).
[26] Total (local + state) property tax revenues decreased following HB 117's passage.

Figure 7. Ridge ASCM effect estimates of New Hampshire's 1994 SFR on state revenues & expenditures



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

Figure 8. Ridge ASCM effect estimates of New Hampshire's 1994 SFR on property tax revenues



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utility properties. In turn, corporate income tax revenues (which includes business enterprise and business profits tax revenues) and documentary/stock transfer tax revenues (which includes real estate transfer tax revenues) increased in New Hampshire after HB 117's enactment (FYs 2000-2004) relative to the state's synthetic control (see Figure 7).[27] The bill also dedicated revenues from future increases in the tobacco tax to the education trust fund and designated certain tobacco settlement funds received by the state for education funding.

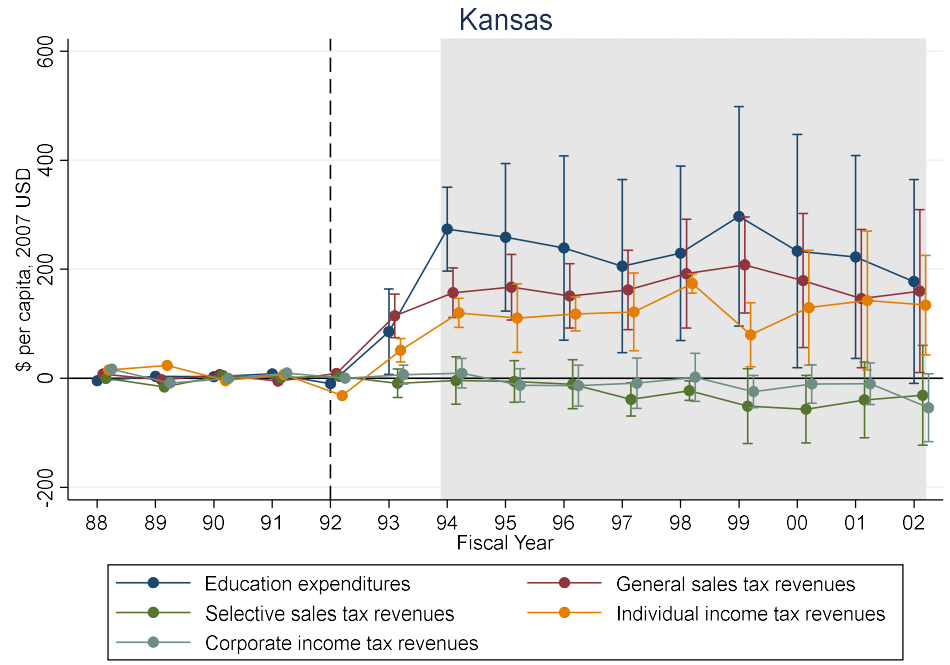
Kansas: The School District Finance and Quality Performance Act (FY 1992)

Throughout the late 1980's and early 1990's, 42 Kansas districts filed four separate legal challenges regarding the constitutionality of the current state school finance system under the School District Equalization Act [SDEA]. These legal challenges were consolidated into one case, and in 1991, a district court judge indicated in a pre-trial ruling that if the case went to trial, he would likely declare that the SDEA violated the state constitution's requirement that the legislature "make suitable provision for finance of the educational interests of the state" (*Mock v. State,* 1991). Subsequently, the Kansas Governor (Joan Finney) established a task force for determining a new state school funding formula, and in 1992, the Kansas Legislature passed the School District Finance and Quality Performance Act [SDFQPA] (1992). The SDFQPA, which went into effect in FY 1994, established a foundation grant program.[28] The funding scheme also included a variety of special weightings or cost adjustments to accommodate differences in district characteristics and differences in the student populations served by districts. In the nine

[27] I do not find that selective sales tax revenues (which includes rooms and meals sales tax revenues) significantly increased in New Hampshire after HB 117's enactment (FYs 2000-2004) relative to the state's synthetic control. This is likely due to the rooms and meals sales tax revenues making up a small proportion of selective sales tax revenues.

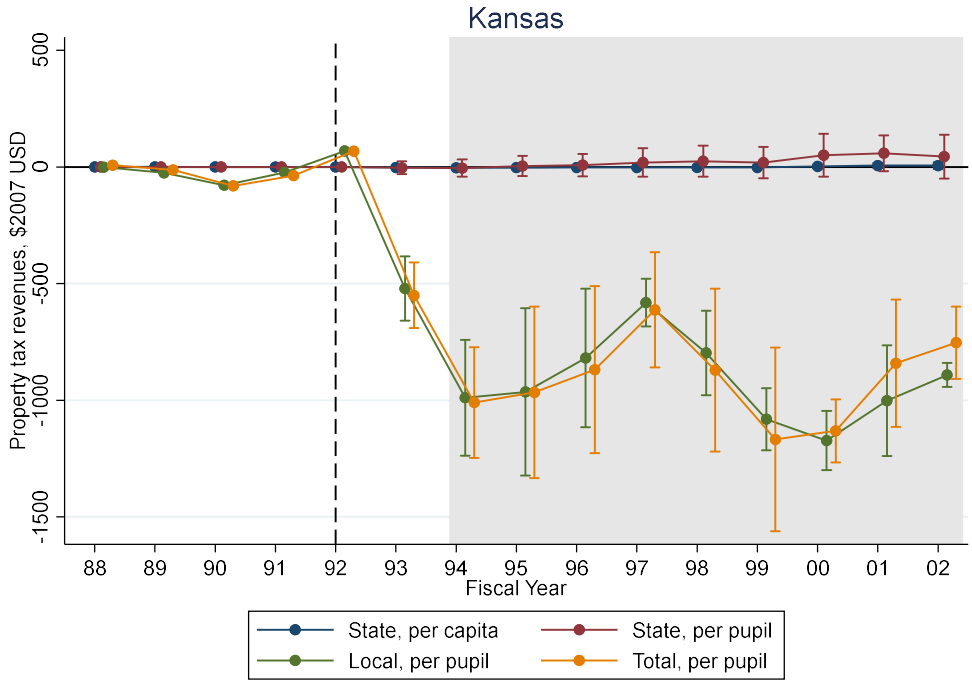
[28] A provision of SDFQPA known as the Local Option Budget (LOB) also permitted districts to raise additional funding 25% above the base foundation grant if approved by local citizens (Johnston & Duncombe, 1998; Thompson & Clark, 2001).

Figure 9. Ridge ASCM effect estimates of Kansas' 1992 SFR on state revenues and expenditures



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

Figure 10. Ridge ASCM effect estimates of Kansas' 1992 SFR on property tax revenues



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years following the SDFQPA's enactment (FYs 1994-2002), Kansas' per capita state education expenditures were approximately $242 higher on average compared to the state's synthetic counterfactual (see Figure 9).[29]

The SDFQPA funded increased state education expenditures by raising state tax revenues while simultaneously reducing local property tax burdens. State tax increases included raising the state general sales tax rate (from 4.25% to 4.9%), enacting higher individual and corporate income tax rates, and eliminating various sales tax exemptions (Johnston & Duncombe, 1998; Thompson & Clark, 2001). As shown in Figure 9, increased general sales and individual income tax revenues enabled the bulk of new education funding, with general sales tax revenues increasing by $168 on average and individual income tax revenues increasing by $133 on average in the five years post-SDFQPA (FYs 1994-2002).[30] The SDFQPA also required districts to impose a uniform local property tax rate,[31] which ultimately resulted in lower local property tax revenues (a decrease of $905 per pupil on average; see Figure 10) and property tax relief for citizens.[32]

Arkansas: *Lake View v. Huckabee* and the Equitable School Finance System Act (FY 1995)

In December 1994, the court declared in *Lake View v. Huckabee* (1994) that Arkansas' state education funding system was unconstitutional and that the state had two years to enact a new funding scheme. In February 1995, the Arkansas General Assembly approved the Equitable

[29] By FY 1999, Kansas' *per pupil* state education expenditures were not statistically different from those of the synthetic control group. Similarities in per pupil state education expenditures between Kansas and the synthetic control group post-1999 may have been related to the Kansas legislature failing to sufficiently raise the per pupil base foundation grant in the years following the SDFQPA's passage (see Berger, 1998; Thompson & Clark, 2001).
[30] As also shown in Figure 9, selective sales tax and corporate income tax revenues were not statistically different from those of Kansas' synthetic counterfactual.
[31] The uniform tax rate was 32 mills in 1992; 33 mills in 1993; 35 mills in 1994 through 1996; 27 mills in 1997; and 20 mills in 1998 (Thompson & Clark, 2001).
[32] If local property tax revenues were greater than a district's base foundation grant, the excess local revenues were remitted to the state and then redistributed to other "property poor" districts (Johnston & Duncombe, 1998; Thompson & Clark, 2001).

School Finance System Act, more commonly known as Act 917.[33] Under Act 917, which went into effect in FY 1997, the General Assembly implemented an equalization school funding formula. Equalization plans typically supplement local funding by providing a block grant to districts based on certain characteristics, such as local tax base or revenues (Shores et al., 2021). In the nine years following Act 917's passage [FYs 1997-2005], Arkansas' per capita state education funding increased by $217, on average, relative to its synthetic counterfactual (see Figure 11).

Act 917 enabled increased state education funding by replacing local property tax rates that varied by district with a state-controlled uniform property tax rate or "base millage rate".[34] The state both collected and redistributed the revenues which were raised from the uniform property tax. As shown in Figure 12, per capita state property tax revenues increased by approximately $127 on average (per pupil property tax revenues increased by $750 on average) relative to Arkansas' synthetic control group after Act 917's enactment (FYs 1997-2005). In contrast, local property tax revenues decreased over the same time period (per pupil property tax revenues decreased by $292 on average).[35]

In February 2004, the General Assembly further increased state education funding by passing Act 107 (Second Extraordinary Session, 2003). Effective in March of 2004, Act 107 increased the state sales and use tax rate by .875 percent, expanded the services that state general sales tax applies to, and increased the wholesale vending tax in order to provide additional revenues for elementary-secondary education. In turn, per capita general sales tax revenues

[33] Act 1307, which was passed by the General Assembly in April 1997, amended various sections of Act 917.
[34] In November 1996, Amendment 74 to the Arkansas Constitution was passed. This amendment enacted a base millage rate of twenty-five mills for all school districts. It further allowed school districts to levy additional property taxes above the uniform property tax rate if approved by local voters (see Article 14, Section 3, of the Arkansas State Constitution).
[35] Total (local + state) property tax revenues increased by $634 per pupil on average following HB Act 917's passage (FYs 1997-2005).

.Figure 11. Ridge ASCM effect estimates of Arkansas 1995 SFR on state revenues and expenditures

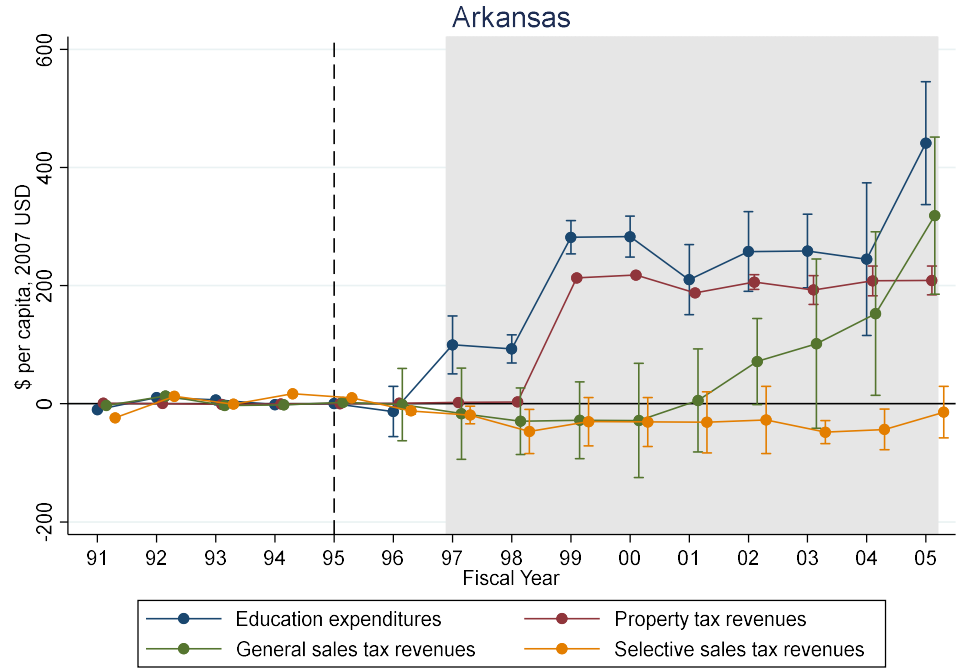

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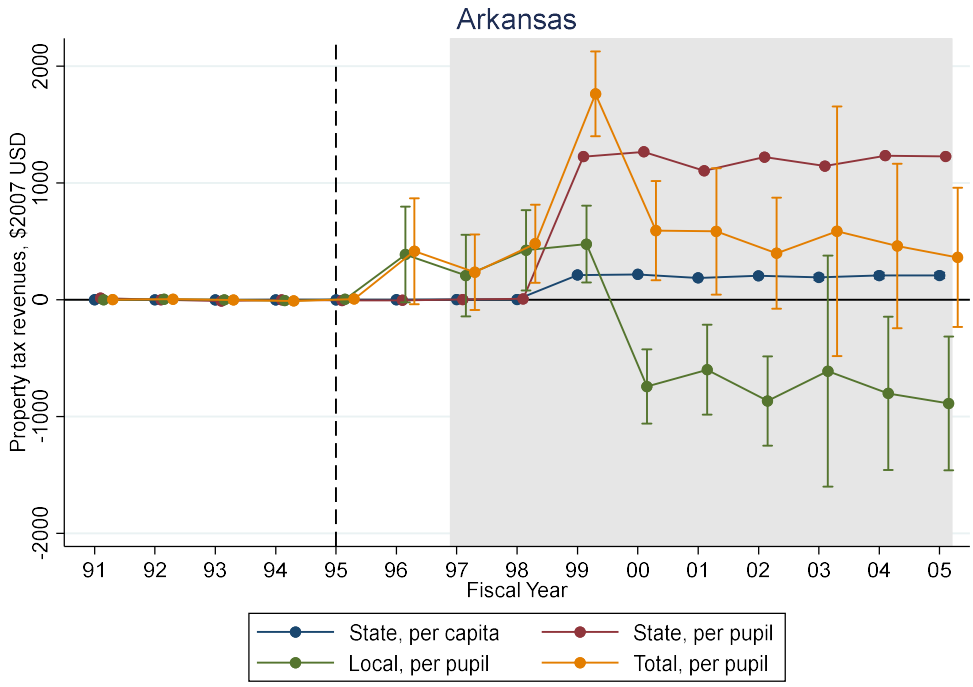
Figure 12. Ridge ASCM effect estimates of Arkansas' 1995 SFR on property tax revenues



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increased by $152 in 2004 and by $318 in 2005 compared to Arkansas' synthetic counterfactual (see Figure 11).[36] By 2005, Arkansas' per capita state education funding had risen by $441 relative to the synthetic control group

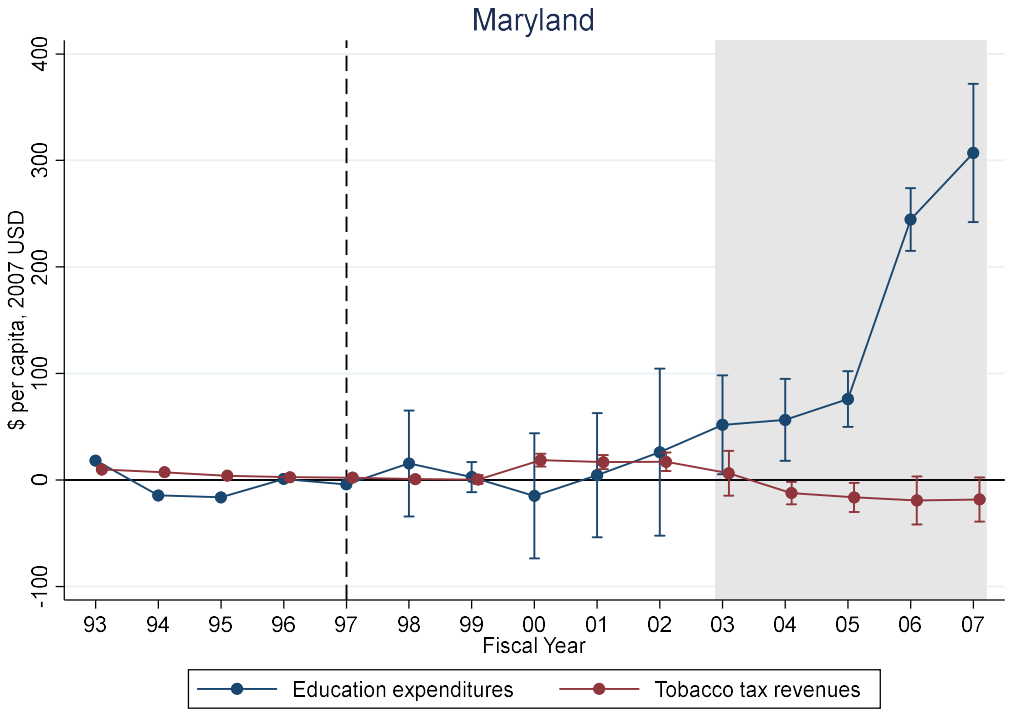
Maryland: *Bradford v. Maryland State Board of Education* (FY 1997)

In FY 1997, the court ruled in *Bradford v. Maryland State Board of Education* (1996) that students in Baltimore City public schools were not receiving a constitutionally adequate education. After the court ruling, Maryland's General Assembly and Governor established a commission to study the school finance system of Maryland and calculate the cost of providing an adequate education.[37] In January 2002, the commission issued its final recommendations, which included revising the state school funding formula and increasing state education expenditures by $1.1 billion (Commission on Education Finance, Equity, and Excellence, 2002). Based on the commission's recommendations, the Maryland General Assembly passed the Bridge to Excellence in Public Schools Act (Senate Bill 856) in FY 2002. The Bridge to Excellence [BTE] Act implemented a foundation program funding scheme, where districts were provided with a uniform per pupil base amount of funding that the state estimated to be the minimum amount required to provide an adequate education. BTE also called for an increase in state education funding, especially in districts with large populations of children from educationally disadvantaged backgrounds, which was to be phased in over six years. As shown in Figure 13, per capita education spending subsequently increased in Maryland in the five years

[36] I do not find that selective sales tax revenues (which includes wholesale vending tax revenues) significantly increased in Arkansas after Act 107's enactment (FYs 2004-2005) relative to the state's synthetic control. This is likely due to wholesale vending tax revenues making up a small proportion of selective sales tax revenues.
[37] The commission's formal name was the Commission on Education Finance, Equity, and Excellence. The commission was also referred to as the Thornton Commission after its chairman, Alvin Thornton.

following the passage of BTE.[38] Per capita state education expenditures were approximately $137 higher on average in FYs 2003-2007 compared to Maryland's synthetic counterfactual.

Figure 13. Ridge ASCM effect estimates of Maryland's 1997 SFR on state revenues and expenditures



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

BTE required taxes on cigarettes to be raised from 66 cents to a $1 per pack in FY 2003 in order to fund the first year of increased state education expenditures. Tobacco tax revenues and education expenditures subsequently increased by similar amounts in FY 2003 (see Figure

[38] I do not examine state education expenditures in the sixth year (FY 2008) following BTE as I only examine the effects of SFRs on state finances through FY 2007 (the last FY prior to the Great Recession).

13).[39] However, the Act did not specify a revenue source to fund the remaining five years (FYs 2004-2008) of mandated education spending increases.[40] Searches by the author through state finance documents and news articles on BTE and Maryland state education funding during this time period did not provide any additional details regarding revenue sources. Further, quantitatively examining the effects of Maryland's SFR on state revenue and expenditure categories using ridge ASCM also did not provide any evidence of funding sources that could be corroborated with legislative documents.

New Jersey: *Abbott v. Burke II* & the Quality Education Act (FY 1991)

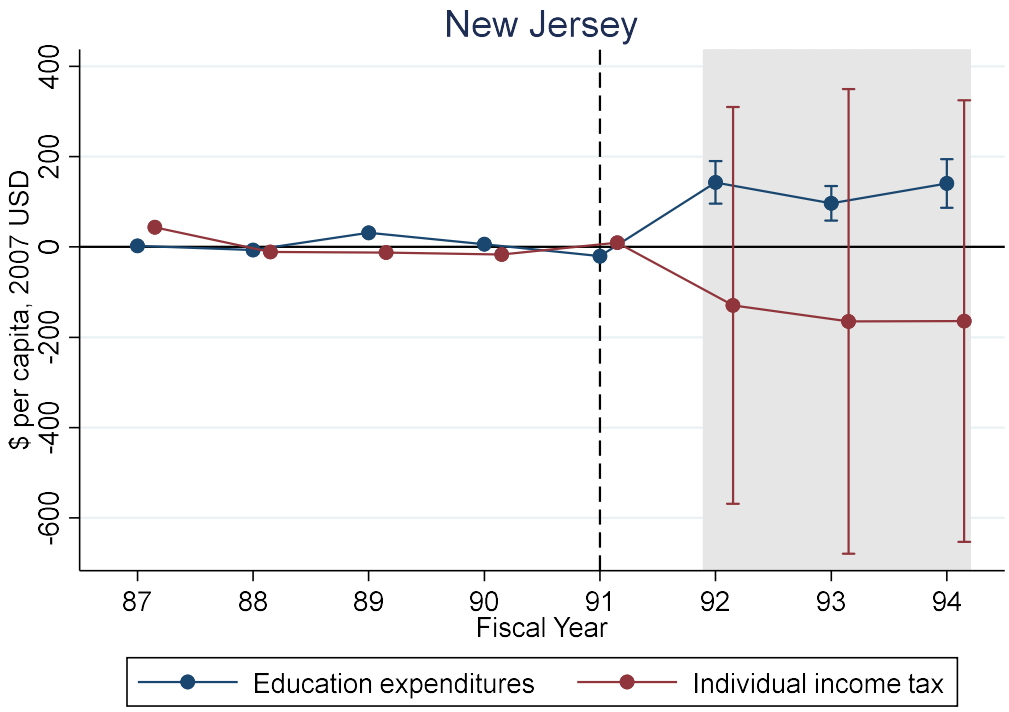
In June 1990, the New Jersey Supreme Court ruled in *Abbott v. Burke II* that the State's school funding formula was unconstitutional as it led to significant expenditure disparities between lower-income, urban (referred to as "special needs") districts and wealthier, suburban districts. In response to the *Abbott II* decision, the Legislature approved the Quality Education Act [QEA] in July 1991, with the Act going into effect in the 1991-92 school year. The QEA called for increased foundation aid levels, restricted state aid to the wealthier districts, and increased state aid to special needs districts. As a result, per capita education spending in New Jersey increased in FY 1992 (the first year of the QEA) through FY 1994 by approximately $124 on average compared to its synthetic counterfactual (see Figure 14).[41]

[39] While tobacco tax revenues did not significantly increase in FY 2003, the confidence intervals associated with the FY 2003 tobacco tax effect estimate and elementary-secondary education effect estimate overlap. Thus, I cannot reject the possibility that tobacco tax revenues and education expenditures in New Jersey rose by similar amounts in FY 2003.

[40] In Maryland, an act does *not* have to identify a revenue source for future proposed spending, per a 1978 amendment to the state constitution (Norcross, 2010).

[41] In 1994, the Court ruled in *Abbott v. Burke III* that the QEA was unconstitutional as it failed to ensure parity between special needs and higher-income, suburban districts as required in *Abbott II*. Thus, the QEA reform was no longer enacted in FY 1995, and state education expenditure levels in FY 1995 were similar to those pre-reform (see Figure 1).

Figure 14. Ridge ASCM effect estimates of New Jersey's 1991 SFR on state revenues and expenditures



Notes: Because Figure 3 through Figure 14 are similar in appearance, detailed notes regarding how to interpret figures are only provided after Figures 3 & 4 for parsimony.

To fund increased state education expenditures under the QEA, the New Jersey Governor (James Florio) and the Legislature revised general income tax rates for (approximately) the top 20 percent of taxpayers. The new income tax structure raised rates for married joint filers with incomes over $70,000 and for single return filers with incomes over $35,000 by 1.5 to 3.5 percentage points. The marginal tax rate applied to taxpayers in the highest income tax bracket (over $150,000 for married joint filers and over $75,000 for single return filers) was doubled, going from 3.5 percent to 7.0 percent (P.L. 1990, c.61). Subsequently, income tax revenues in New Jersey increased to a similar degree as education expenditures in the three years following the QEA's enactment (FYs 1992-94; see Figure 14).[42]

[42] Income tax revenues did not significantly increase during FYs 1992-94 based on the results shown in Figure 14. However, the income tax ridge ASCM effect estimates are imprecise relative to the education expenditure effect estimates, with the upper bounds of the confidence intervals associated with the income tax estimates encompassing

Discussion

This paper provides novel evidence of how SFR-induced increases in state education spending are funded. In short, I find that six of the seven state SFRs examined in this study were funded by altering tax rates and revenues. However, none of these six state legislatures altered the exact same set of tax revenues, suggesting that there is not one "recipe" for funding SFRs. Specifically, five of the seven states included in my selected analytic sample (Arkansas, Kansas, Michigan, New Hampshire, & Vermont) funded increased state education spending following an SFR by (1) increasing state control over the imposition, collection, and/or distribution of property tax revenues. As a result, local property tax revenues decreased (in all five states) and state property tax revenues increased (in 4/5 states). These five states also paid for increased education expenditures by (2) increasing a variety of other state tax revenues, including general and selective sales tax, individual and corporate income tax, and other tax revenues. In contrast, New Jersey funded its SFR-induced education spending increases by solely raising non-property tax revenues, specifically individual income tax revenues. Lastly, Maryland funded increased state education spending for one year by raising tobacco tax revenues; however, I was unable to determine how the state funded the remaining five years of SFR-mandated education spending increases.

It is interesting to note that the five states that increased control over property tax revenues as well as raised a variety of other state tax revenues (Arkansas, Kansas, Michigan, New Hampshire, & Vermont) experienced larger average increases in state education funding compared to the two states that only increased one, non-property tax revenue (New Jersey and Maryland). Specifically, as detailed in Table 1, the weighted average effect of a state SFR reform

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the education expenditure effect estimates. Thus, income tax revenues and education expenditures in New Jersey could potentially have risen by similar amounts post-reform.

on state education spending was $124 per capita and $137 per capita in New Jersey and Maryland, respectively. In contrast, the weighted average effect of an SFR on state education funding ranged from $217-$980 per capita in Arkansas, Kansas, Michigan, New Hampshire, & Vermont. These findings suggest that larger increases in state education funding are achieved when a) multiple tax revenue streams are increased and when b) states exercise increased control over property tax revenues. However, I acknowledge that these patterns are based on a small sample of seven state SFRs and thus should be interpreted with caution. Future research should examine the relationship between how SFRs are funded and the magnitude of the increase in state education spending using a larger sample of state SFRs.

I find no legislative evidence that non-education state expenditures were reduced or that state debt was increased to fund increased elementary-secondary education spending following an SFR. However, one may wonder if I find no evidence of reduced non-education expenditures or increased debt because such things just aren't mentioned in legislative statutes related to increasing education funding (either because they're not required to be mentioned like raising revenues are or because doing so might have negative ramifications). Because this may certainly be the case, I sought out further evidence by estimating the effects of the seven state SFRs on per capita non-education state expenditures and total state debt outstanding using ridge ASCM. As described in detail in Appendix D, while I do find some evidence that non-education state expenditures were reduced and state debt increased in the years following an SFR in a few states, I was unable to verify or corroborate such findings using other sources of information (e.g., academic journal articles, news articles, published briefs or reports). Without additional corroborating evidence, I am not confident that the effects on non-education expenditures and state debt should be attributed to SFRs (versus other events or policy changes that occurred at the

same time). As such, I recommend further examination into whether SFR-induced increases in state education spending impacts the funding of other state priorities or state deficits.

This paper is the first to use a novel, multi-step approach to determine how SFRs are funded, drawing on evidence from multiple sources (both legislative acts and quantitative finance data). Referencing relevant legislative statutes provided a very detailed accounting of a) which specific state revenue categories were changed and b) to what degree (e.g., how many percentage points a given tax rate was raised). I was also able to verify the impact of this legislative change by quantitatively examining the effect of a state's SFR on the given revenue categories using state finance data. In comparison, research designs that rely solely on quantitative analysis of state finance data are unable to provide the same kind or level of detail as can be obtained from reviewing legislation. Furthermore, one also runs the risk of misattributing changes in state revenues and expenditures to an SFR that were actually the result of other policy reforms happening at the same time.

It is important to note, however, that I was unable to identify how Maryland's 1997 SFR was funded in entirety using the two-step research design. This suggests that some states fund increased education expenditures in ways that are not easily identifiable through reviewing state legislative acts (e.g., like Maryland, some states may not have to specify how they will fund increased spending in legislative acts) or through quantitative analysis of state finance data (e.g., states could be making small changes to several different revenue categories that are not statistically detectable or making changes to revenue categories that the Census Bureau doesn't have a fine-grained measure of). Thus, other methodological approaches, such as in-depth case studies, may need to be used to fully understand the variety of ways in which SFR-induced increases in state education spending are funded.

Ultimately, the findings of this study suggest that examining how SFRs are funded on a state-specific basis is useful in understanding the breadth of possibilities for funding increases in state education spending. Future research should expand upon this work and examine how the myriad of state SFRs which were not included in this study were (or were not) funded.

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Appendix A. Creation of SFR Event List

Appendix Table A1 lists all of the SFRs that have occurred between fiscal years [FYs] 1989 and 2005, based on tabulations by Shores et al. (2021).[1] Both legislative- and court-ordered reforms are included. Minor revisions to names of court orders or legislative bills, as well as historical decision dates, have also been made based on my own research. Historical decision dates of the SFRs, reported in calendar years, were converted into fiscal years that align with the reporting of the expenditure data collected in the Annual Survey of State Government Finances by the U.S. Census Bureau.

The Census Bureau collects financial data so that it covers each state government's own fiscal period, rather than a standard calendar-based reporting period. Most state governments have a fiscal calendar that runs from July 1 to the following June 30, although a few states are exceptions (see state fiscal calendars in the fourth column of Table A1). New York's fiscal calendar runs from April 1 to the following March 31; Texas' fiscal calendar runs from September 1 to the following August 31; and the fiscal calendar for Alabama and Michigan runs from October 1 to the following September 30. I convert historical decision dates of SFRs into fiscal years based on the state and its associated fiscal calendar in which the reform occurred. For example, an SFR that occurred on May 1, 1995, in New York would be coded as occurring in FY 1996 based on New York's April 1 – March 31 fiscal calendar. In contrast, an SFR that occurred on May 1, 1995, in Tennessee would be coded as occurring in FY1995 based on Tennessee's

[1] In addition to the SFRs identified by Shores et al. (2021), I also include Michigan's 1994 passage of Proposal A as a legislative SFR. Shores et al. (2021) did not consider Proposal A to be an SFR because it was a constitutional amendment approved of by state voters (ref. footnote 8). However, Proposal A was originally drafted and referred to voters by the state legislature (and thus is considered a *legislatively-referred* constitutional amendment). Because the legislature was responsible for initiating Proposal A, I consider Proposal A to fall within the definition of a legislative SFR and thus include it in my list of court-ordered and legislative SFRs that occurred between FYs 1989-2005.

July 1 – June 30 fiscal calendar. For more information on the calendar to fiscal year conversion process, see Section 3.2 Fiscal Years as Statistical Reporting Tools of the U.S. Census Bureau's 2006 Government Finance and Employment Manual (https://www.census.gov/govs/classification/).

Appendix Table A1. List of school finance reforms, fiscal years 1989-2005

State	Court Case or Legislative Bill	Historical Decision Date	Fiscal Calendar	Converted Fiscal Year
Alaska	Kasayulie v. State of Alaska	1-Sep-99	Jul 1 - Jun 30	**2000**
Arizona	Roosevelt v. Bishop	21-Jul-94	Jul 1 - Jun 30	**1995**
Arizona	Hull v. Albrecht	23-Dec-97	Jul 1 - Jun 30	1998
Arizona	Hull v. Albrecht	18-Feb-98	Jul 1 - Jun 30	1998
Arkansas	Lake View v. Huckabee I	1-Dec-94	Jul 1 - Jun 30	**1995**
Arkansas	Equitable School Finance System Act (Act 917)	1-Feb-95	Jul 1 - Jun 30	1995
Arkansas	Lake View v. Huckabee II	21-Nov-02	Jul 1 - Jun 30	2003
Arkansas	Lake View v. Huckabee III	5-May-05	Jul 1 - Jun 30	2005
California	Leroy F. Greene School Facilities Act of 1998	27-Aug-98	Jul 1 - Jun 30	**1999**
California	Senate Bill 6, Senate Bill 550, Assembly Bill 1550, Assembly Bill 2727, and Assembly Bill 3001	1-Aug-04	Jul 1 - Jun 30	2005
Colorado	Senate Bill 181; Various Other Acts	1-Jul-00	Jul 1 - Jun 30	**2001**
Idaho	Idaho Schools for Equal Educational Opportunity v. State I	18-Mar-93	Jul 1 - Jun 30	**1993**
Idaho	Senate Bill 1560	1-Mar-94	Jul 1 - Jun 30	1994
Kansas	The School District Finance and Quality Performance Act	20-May-92	Jul 1 - Jun 30	**1992**
Kansas	Montoy v. State; Montoy v. State funding increases	3-Jan-05	Jul 1 - Jun 30	2005
Kentucky	Rose v. Council for Better Education, Inc.	28-Sep-89	Jul 1 - Jun 30	**1990**
Kentucky	Kentucky Education Reform Act (House Bill 940)	24-Mar-90	Jul 1 - Jun 30	1990

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Appendix Table A1 - continued from previous page.

State	Court Case or Legislative Bill	Historical Decision Date	Fiscal Calendar	Converted Fiscal Year
Maryland	Bradford v. Maryland State Board of Education	18-Oct-96	Jul 1 - Jun 30	**1997**
Maryland	Bridge to Excellence in Public Schools Act	6-May-02	Jul 1 - Jun 30	2002
Massachusetts	McDuffy v. Secretary of the Executive Office of Education	15-Jun-93	Jul 1 - Jun 30	**1993**
Massachusetts	Massachusetts Education Reform Act	18-Jun-93	Jul 1 - Jun 30	1993
Michigan	Proposal A	15-Mar-94	Oct 1 – Sep 30	**1994**
Missouri	Committee for Educational Equality v. State of Missouri	1-Jan-93	Jul 1 - Jun 30	**1993**
Missouri	Outstanding Schools Act (Senate Bill 380)	1-Aug-93	Jul 1 - Jun 30	1994
Missouri	Senate Bill 287	29-Jun-05	Jul 1 - Jun 30	2005
Montana	House Bill 667	1-Apr-93	Jul 1 - Jun 30	**1993**
Montana	Columbia Falls Elementary School v. State	22-Mar-05	Jul 1 - Jun 30	2005
New Hampshire	Claremont v. Governor I	30-Dec-93	Jul 1 - Jun 30	**1994**
New Hampshire	Claremont v. II	17-Dec-97	Jul 1 - Jun 30	1998
New Hampshire	Claremont v. Governor III	15-Oct-99	Jul 1 - Jun 30	2000
New Hampshire	Opinion of the Justices–School Financing (Claremont VI)	7-Dec-00	Jul 1 - Jun 30	2001
New Hampshire	Claremont v. Governor IV	11-Apr-02	Jul 1 - Jun 30	2002

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Appendix Table A1 - continued from previous page.

Court Case or Legislative Bill		Historical Decision Date	Fiscal Calendar	Converted Fiscal Year
New Jersey	Abbott v. Burke II	5-Jun-90	Jul 1 - Jun 30	**1990**
New Jersey	The Quality Education Act	3-Jul-90	Jul 1 - Jun 30	1991
New Jersey	Abbott v. Burke III	12-Jul-94	Jul 1 - Jun 30	1995
New Jersey	Comprehensive Educational Improvement and Financing Act of 1996	20-Dec-96	Jul 1 - Jun 30	1997
New Jersey	Abbott v. Burke IV	14-May-97	Jul 1 - Jun 30	1997
New Jersey	Abbott v. Burke V	21-May-98	Jul 1 - Jun 30	1998
New Jersey	Abbott v. Burke VI	7-Mar-00	Jul 1 - Jun 30	2000
New Mexico	Zuni School District v. State	14-Oct-99	Jul 1 - Jun 30	**2000**
New Mexico	Deficiencies Corrections Program; Public School Capital Outlay	5-Apr-01	Jul 1 - Jun 30	2001
New York	Campaign for Fiscal Equity, Inc. v. State	26-Jun-03	Apr 1- Mar 31	**2004**
North Carolina	Leandro v. State	24-Jul-97	Jul 1 - Jun 30	**1998**
North Carolina	Hoke County Board of Education v. State	30-Jul-04	Jul 1 - Jun 30	2005
Ohio	DeRolph v. State I	25-Apr-97	Jul 1 - Jun 30	**1997**
Ohio	DeRolph v. State II	11-May-00	Jul 1 - Jun 30	2000
Ohio	DeRolph v. Ohio III	6-Sep-2001	Jul 1 - Jun 30	2002
Ohio	DeRolph v. Ohio IV	11-Dec-02	Jul 1 - Jun 30	2003
Tennessee	The Education Improvement Act	11-Mar-92	Jul 1 - Jun 30	**1992**
Tennessee	Tennessee Small School Systems v. McWheter I	22-Mar-93	Jul 1 - Jun 30	1993
Tennessee	Tennessee Small School Systems v. McWheter II	16-Feb-95	Jul 1 - Jun 30	1995

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Appendix Table A1 - continued from previous page.

State	Court Case or Legislative Bill	Historical Decision Date	Fiscal Calendar	Converted Fiscal Year
Tennessee	Tennessee Small School Systems v. McWheter III	8-Oct-02	Jul 1 - Jun 30	2003
Texas	Edgewood ISD v. Kirby	22-Jan-91	Sept 1 - Aug 31	**1991**
Texas	Carrolton-Farmers Branch ISD v. Edgewood ISD	30-Jan-92	Sept 1 - Aug 31	1992
Texas	Senate Bill 7	31-May-93	Sept 1 - Aug 31	1993
Vermont	Brigham v. State	5-Feb-97	Jul 1 - Jun 30	**1997**
Vermont	Revisions to Act 68; H.480	18-Jun-03	Jul 1 - Jun 30	2003
West Virginia	Tomblin v. Gainer	1-Aug-00	Jul 1 - Jun 30	**2001**
Wyoming	Campbell County School District v. State I	8-Nov-95	Jul 1 - Jun 30	**1996**
Wyoming	The Education Resource Block Grant Model	Apr-97	Jul 1 - Jun 30	1997
Wyoming	Wyoming Comprehensive Assessment System	Jun-97	Jul 1 - Jun 30	1997
Wyoming	Campbell County School District v. State II; Recalibration of the MAP model	23-Feb-01	Jul 1 - Jun 30	2001

Notes: Bolded survey years indicate the first year that a state's funding system was altered in the adequacy era by a legislative or court-ordered SFR reform and is considered the start of treatment.

Appendix B. SCM and Ridge ASCM

Traditional SCM Notation

I discuss the traditional synthetic control method (SCM), which serves as the basis for ridge ASCM, within the context of this study. I use similar notation as Abadie, Diamond, and Hainmueller (2010) and Ben-Michael et al. (2020). I first describe general notation regarding sample and time frame. During the analysis period of this study (fiscal years 1988-89 to 2006-07), 24 states experienced an SFR and thus are considered treated, while 26 states did not experience an SFR and thus are considered control. In order to compute state-specific treatment effect estimates, I run separate synthetic control models for each treated state. Thus, my analytic sample, s, includes 1 treated state + 26 non-treated control states = 27 states for any given analysis. I designate the first unit of the analytic sample (i.e., $s = 1$) to be the treated state.

My dataset includes 26 years of fiscal data on state revenues and expenditures, from fiscal years 1981-82 to 2006-07. Fiscal years are denoted as t, where $t \in \{1, 2, \ldots, 26\}$. Although I observe all 26 fiscal years of data for each state, the number of years before an SFR (i.e., pre-treatment years) and the number of years after an SFR (i.e., post-treatment years) will vary by treated state depending on when their SFR occurred. I denote the number of pre-treatment years as T_0. Because I assume treatment begins in the *following* fiscal year after an SFR occurs, I operationalize T_0 to include the fiscal year in which an SFR occurs. The first SFR that occurred during this study's analytic period was in fiscal year 1990 (Kentucky) and the most recent was in fiscal year 2004 (New York). Thus, T_0 ranges from 9 to 23 depending on the treated state.

SCM formally estimates dynamic treatment effects as:

$$\hat{\gamma}_{1t}^{SCM} = Y_{1t} - \hat{Y}_{1t}^{SCM}(0) = Y_{1t} - \sum_{s=2}^{27} \hat{w}_s^{SCM} Y_{st} \text{ for } t > T_0, \quad (1)$$

where $\hat{\gamma}_{1t}^{SCM}$ represents the estimated treatment effect for treated state $s = 1$ at time t, Y represents the expenditure or revenue outcome of interest, and $\hat{w}_s^{SCM}$ is a time-invariant, optimally chosen weight for each state s in the non-treated control group. T_0 represents the number of pre-treatment years. $\hat{w}_s^{SCM} Y_{st}$ can be interpreted as a weighted average of control outcomes, and it characterizes the counterfactual outcome of the treated state in year t if it had not undergone reform.

The state-specific weights w_s^{SCM} are estimated using a minimization procedure that attempts to set all differences between the pre-treatment outcomes of the treated state and the pre-treatment outcomes of the non-treated control states to zero. Pre-treated outcomes are denoted as X_{st}. Specifically, the minimization procedure attempts to satisfy the following conditions for $t \leq T_0$:

$$\begin{aligned} \sum_{s=2}^{27} w_s^{SCM} X_{s1} &= X_{11} \\ \sum_{s=2}^{27} w_s^{SCM} X_{s2} &= X_{12} \\ &\vdots \\ \sum_{s=2}^{27} w_s^{SCM} X_{sT_0} &= X_{1T_0}, \end{aligned} \quad (2)$$

where $w_2^{SCM} + w_3^{SCM} + \cdots w_s^{SCM} = 1$. In other words, the sum of all weights must equal one. The system of equations above demonstrates that the weighted average of the 26 non-treated control states attempts to balance the treated state's pre-treatment outcomes as closely as

possible. Non-treated control states that more closely resemble the pre-treatment outcome level and trend of the treated state receive larger weights than non-treated control states that less closely resemble the pre-treatment outcome level and trend of the treated state. Abadie et al. (2015) note that if the number of pre-treatment periods in the data is "large", then matching on pre-treatment outcomes can allow one to control for heterogenous responses to multiple unobserved factors. The idea here is that only units that are alike on unobservable and observable characteristics would follow a similar trajectory pre-treatment.

Ridge ASCM Notation

Ben-Michael et al. (2020) note that SCM should only be used when the level and trend of the synthetic control's pre-treatment outcomes closely match the level and trend of the treated unit's pre-treatment outcomes. If the SCM weights do not achieve good pre-treatment fit, then SCM estimates can be biased. Ben-Michael et al. (2020) propose the ridge augmented synthetic control method [ridge ASCM] as the preferred alternative when good pre-treatment fit using SCM is not feasible. In short, ridge augmentation provides a way to avoid overfitting to noisy or poor pre-treatment outcome data by taking the traditional SCM estimate, estimating the bias due to poor pre-treatment fit, and then augmenting the traditional SCM estimate by adding a bias correction term. In formal terms, ridge SCM estimates dynamic treatment effects as:

$$\hat{Y}_{1t}^{AUG} = Y_{1t} - \hat{Y}_{1t}^{AUG}(0) = Y_{1t} - \left[\underbrace{\sum_{s=2}^{27} \hat{w}_s^{SCM} Y_{st}}_{(1)\ SCM\ estimate} + \underbrace{\underbrace{\left(X_{1\cdot} - \sum_{s=2}^{27} \hat{w}_s^{SCM} X_{s\cdot} \right)}_{(a)\ SCM\ pre-treatment\ matc\ quality\ vector} \cdot \underbrace{\hat{\eta}_t^r}_{(b)\ Rigde\ coefficient\ vecto}}_{(2)\ Bias\ correction} \right] \quad \text{for } t > T_0. \tag{3}$$

The *(1) SCM estimate* term can be interpreted as the weighted average of non-treated control outcomes, $\widehat{Y}_{1t}^{SCM}(0)$, and was previously shown and described in the traditional SCM Equation (1). I now turn to describing the *(2) Bias correction* term from Equation (3).

The bias correction term can be broken down into two parts: (a) the SCM pre-treatment match quality vector and (b) the ridge coefficient vector. The SCM pre-treatment match quality vector is a 1-by-T_0 row vector that accounts for the differences between the treated unit and the SCM counterfactual unit for each pre-treatment year *t*. This match quality vector is calculated using $X_{1.}$, which represents a 1-by-T_0 row vector of pre-treatment outcomes for treated state $s = 1$. $X_{s.}$ is also a 1-by-T_0 row vector of pre-treatment outcomes but for each non-treated control state *s,* where $s \in \{2, 3, \ldots, 27\}$. Each $X_{s.}$ row vector is multiplied by the state-specific weight $\widehat{w}_s^{SCM}$. If the pre-treatment differences between the treated unit and the SCM counterfactual unit are small, then SCM pre-treatment match quality is good; if the pre-treatment differences are large, then SCM pre-treatment match quality is poor.

The ridge coefficient vector, $\hat{\eta}_t^r$, is a T_0-by-1 column vector of coefficients that account for the estimated relationship between pre-treatment outcomes and post-treatment outcomes at post-treatment year *t* for the *non-treated control* states. The ridge coefficients contained in $\hat{\eta}_t^r$ are estimated using multivariate ridge regression. In simple terms, ridge regression will reduce the $\hat{\eta}_t^r$ coefficient estimates of the relationship between pre-treatment and post-treatment outcomes for the non-treated control states by adding a penalty term. This penalty term leads to a more parsimonious model that will likely perform better at predicting the relationship between pre-treatment and post-treatment outcomes for the *treatment* state. Specifically, multivariate ridge regression involves regressing the centered, post-treatment outcomes for non-treated control states for post-treatment year *t*, $\tilde{Y}_{st}$, on the centered, pre-treatment outcomes for non-treated

control states, $\tilde{X}'_{s.}$, plus the penalty term. The following minimization problem provides the full ridge coefficient matrix, $\hat{\eta}^r$:

$$\min_{\eta^r} \frac{1}{2} \sum_{s=2}^{27} \sum_{t=T_0+1}^{T} \underbrace{\left(\tilde{Y}_{st} - \tilde{X}'_{s.}\eta^r\right)^2}_{\substack{Sum\ of\ squared \\ residuals}} + \underbrace{\lambda^r \|\eta^r\|_2^2}_{\substack{Penalty \\ term}} \tag{4}$$

The penalty term is comprised of a penalty parameter, λ^r, and an L2 penalty, $\|\eta^r\|_2^2$. The L2 penalty is equal to the sum of the squared ridge coefficients contained in η^r. The penalty parameter, λ^r, controls the strength of the penalty term by influencing the magnitude of the η^r coefficient estimates. As $\lambda^r \to \infty$, the η^r coefficient estimates shrink towards zero. When the η^r coefficient estimates are smaller, the bias correction term in Equation 3 is also smaller, leading the ridge ASCM estimate of $Y_{1t}(0)$ to converge to the SCM estimate of $Y_{1t}(0)$. As $\lambda^r \to 0$, the η^r coefficient estimates converge towards the coefficient estimates obtained from least squares regression. When the η^r coefficient estimates are larger, the bias correction term in Equation 3 is also larger, leading the ridge ASCM estimate of $Y_{1t}(0)$ to diverge from (and become larger than) the SCM estimate of $Y_{1t}(0)$.

As shown above, the value of the penalty parameter, λ^r, influences the magnitude of the η^r coefficient estimates, which in turn influences the magnitude of the $\hat{Y}_{1t}^{AUG}(0)$ counterfactual estimate. So how does one determine the value of λ^r? Following Ben-Michael et al. (2020), I use a leave-one-out cross-validation procedure to choose the value of λ^r. Specifically, for a given value of λ^r, I estimate $\hat{X}_{1t}^{AUG}(0)$ across pre-treatment periods (i.e., $t \leq T_0$) using the following ridge ASCM model and data that *excludes* time period *t:*

$$\hat{X}_{1t}^{AUG} = \underbrace{\sum_{s=2}^{27} \hat{w}_s^{SCM} X_{s(-t)}}_{(1)\ SCM\ estimate} + \underbrace{\underbrace{\left(X_{1\cdot(-t)} - \sum_{s=2}^{27} \hat{w}_s^{SCM} X_{s\cdot(-t)} \right)}_{(a)\ SCM\ pre-treatme\ match\ quality\ vector} \cdot \underbrace{\hat{\eta}_{(-t)}^{r}}_{(b)\ Rigde\ coefficient\ vect}}_{(2)\ Bias\ correction}, \qquad for\ t < T_0. \quad (5)$$

I then compute the mean squared error (MSE) across pre-treatment periods as follows:

$$CV(\lambda^r) = \sum_{t=1}^{T_0} \left(X_{1t} - \hat{X}_{1t}^{AUG} \right)^2 \quad (6)$$

I select λ^r as the maximum λ^r with MSE within one standard deviation of the minimum MSE computed from Equation 6.

All ridge ASCM models are estimated using R's *augsynth* command (Ben-Michael, 2020). Standard errors are based on a row-based jackknife to allow for autocorrelation within states (Ben-Michael et al., 2019).

Appendix C. Evaluating Education Expenditure Ridge ASCM Estimates

I evaluate the quality and validity of the per capita and per pupil elementary-secondary education expenditure ridge ASCM estimates using the following three tests. First, I examine whether good pre-treatment fit is achieved by the ridge ASCM models. To assess pre-treatment fit, I plot the dynamic effect estimates for each of the 24 states that experienced an SFR between FY 1989 and 2005. These plots visually illustrate the quality of the pre-treatment match. As shown in Figure C1, effect estimates prior to the fiscal year of the SFR reform (indicated by the vertical dashed line) are close to zero for most states. Thus, the level and trend of each treated state's pre-treatment outcomes appear to closely match the level and trend of its synthetic control's pre-treatment outcomes, suggesting that good pre-treatment fit is achieved.

Second, I assess the percent improvement in the L^2-norm model fit statistic obtained from the per capita and per pupil elementary-secondary expenditures ridge ASCM models relative to the L^2-norm statistic obtained from models that use equal or SCM weights. The L^2-norm statistic indicates the cumulative pre-treatment effect size deviation from zero. A percent improvement value that is closer to 0% indicates that a ridge ASCM model has similar pre-treatment fit as models that use equal or SCM weights. A percent improvement value that is closer to 100% indicates that a ridge ASCM model has better pre-treatment fit than models that use equal or SCM weights.

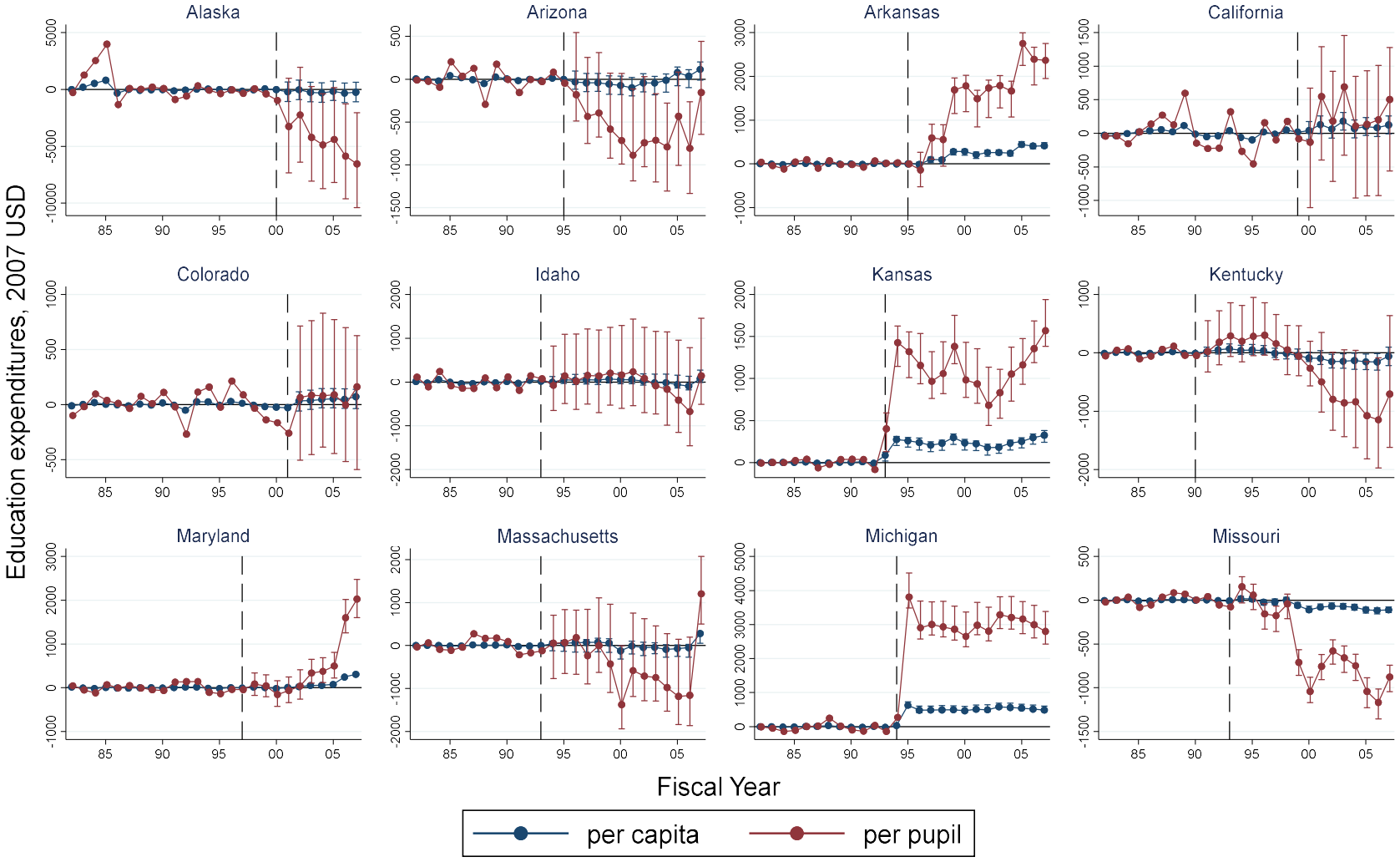
As shown in Figure C2, ridge ASCM models always have better pre-treatment fit than models that use equal weights. For the majority of states, using ridge ASCM weights does not improve pre-treatment fit relative to SCM weights, which suggests that augmenting the traditional SCM estimate by adding a bias correction term (as is done when using ridge ASCM) is not really beneficial. However, for a few states (Alaska, California, Massachusetts, New

Hampshire, New Mexico, Tennessee, and West Virginia), model fit is improved by using ridge ASCM relative to traditional SCM.

Third, I test the sensitivity of the average (i.e., across the treated years) effect estimates, $\bar{\hat{\gamma}}_1^{AUG}$, obtained from the per capita and per pupil elementary-secondary expenditures ridge ASCM models to different values of the penalty parameter, λ^r (the penalty parameter is discussed in detail in Appendix B). Specifically, I estimate ~100 alternative specifications of the ridge ASCM models with imposed values of λ^r between $1 \times 10^{-7}$and 9×10^5. In order to compare the average effect estimate from a model with a specified λ^r to the average effect estimate from my preferred model with a cross-validated λ^r, I calculate an $\widehat{effect}^{ratio}$ statistic equal to $\widehat{effect}^{L(\lambda)} / \widehat{effect}^{CV(\lambda)}$. $\widehat{effect}^{L(\lambda)}$ is the average effect estimate for specification *L* given penalty parameter λ^r, and $\widehat{effect}^{CV(\lambda)}$ is the average effect estimate from my preferred model with a cross-validated λ^r. To present the $\widehat{effect}^{ratio}$ statistics in a digestible manner, I calculate and plot the median $\widehat{effect}^{ratio}$ for each state and outcome (per capita and per pupil elementary-secondary expenditures).

As shown in Figure C3, I find that the median $\widehat{effect}^{ratio}$ for per capita and per pupil education expenditures are centered around one for most states. This implies that the value of λ^r is largely inconsequential in determining the average effect estimate. However, for a few states (California, Colorado, Idaho, and New York), the median $\widehat{effect}^{ratio}$ for per pupil education expenditures is more widely dispersed. This implies that using the cross-validation procedure to select the value of λ^r is useful in that it prevents one from subjectively choosing the λ^r value.

Appendix Figure C1. Ridge ASCM effect estimates of SFRs on per capita and per pupil elementary-secondary education expenditures



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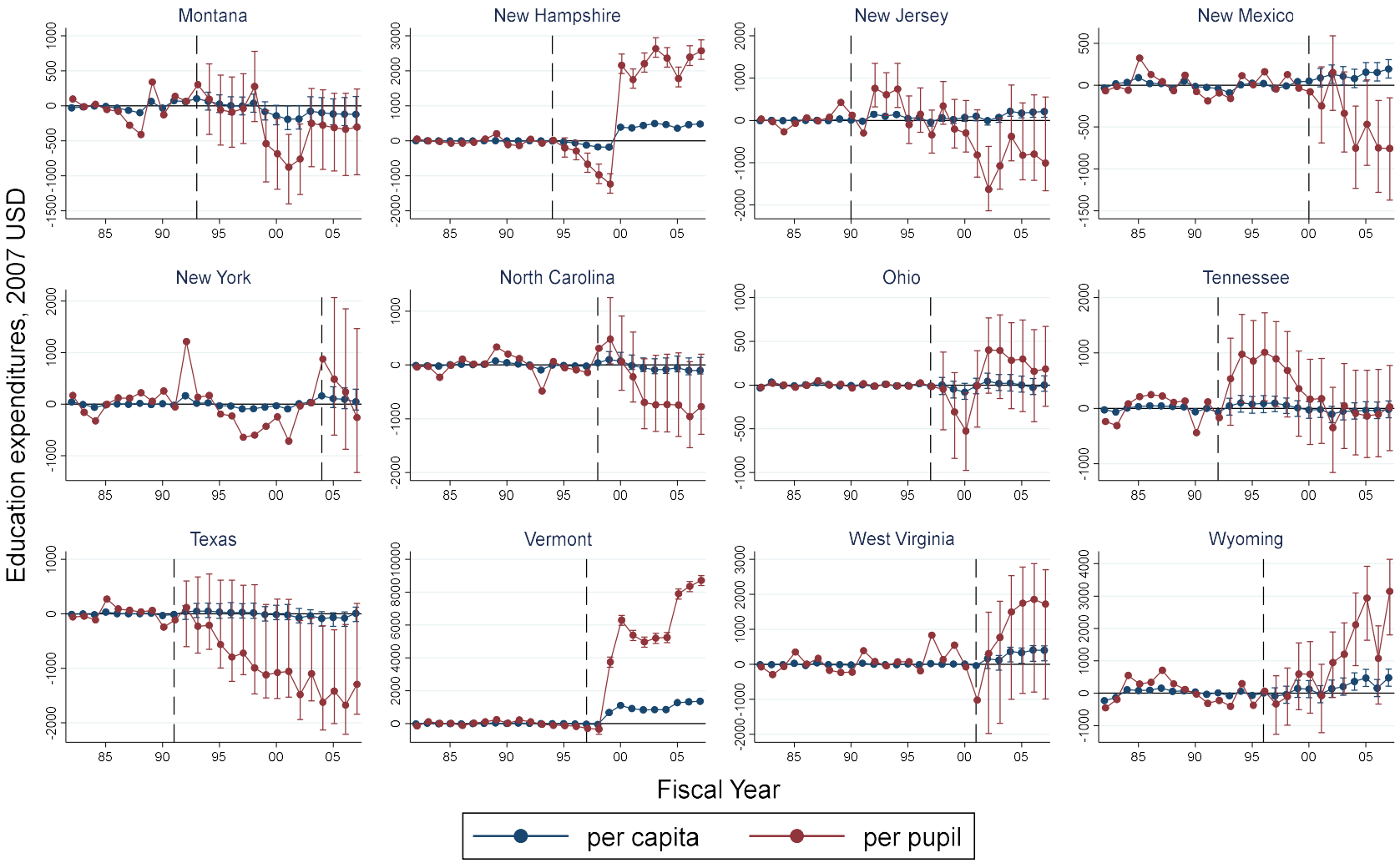
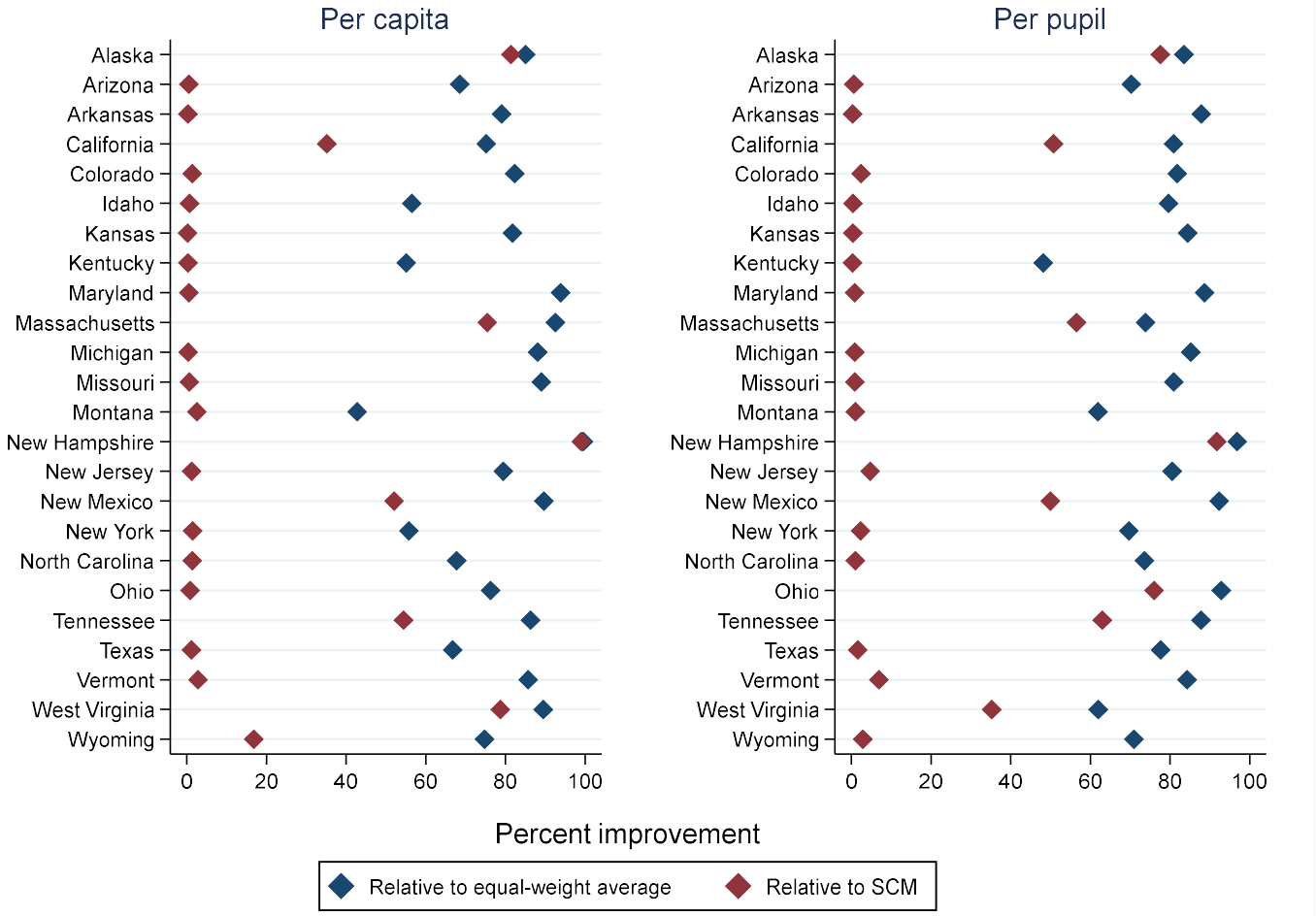
Appendix Figure C1. Ridge ASCM effect estimates – continued from previous page.



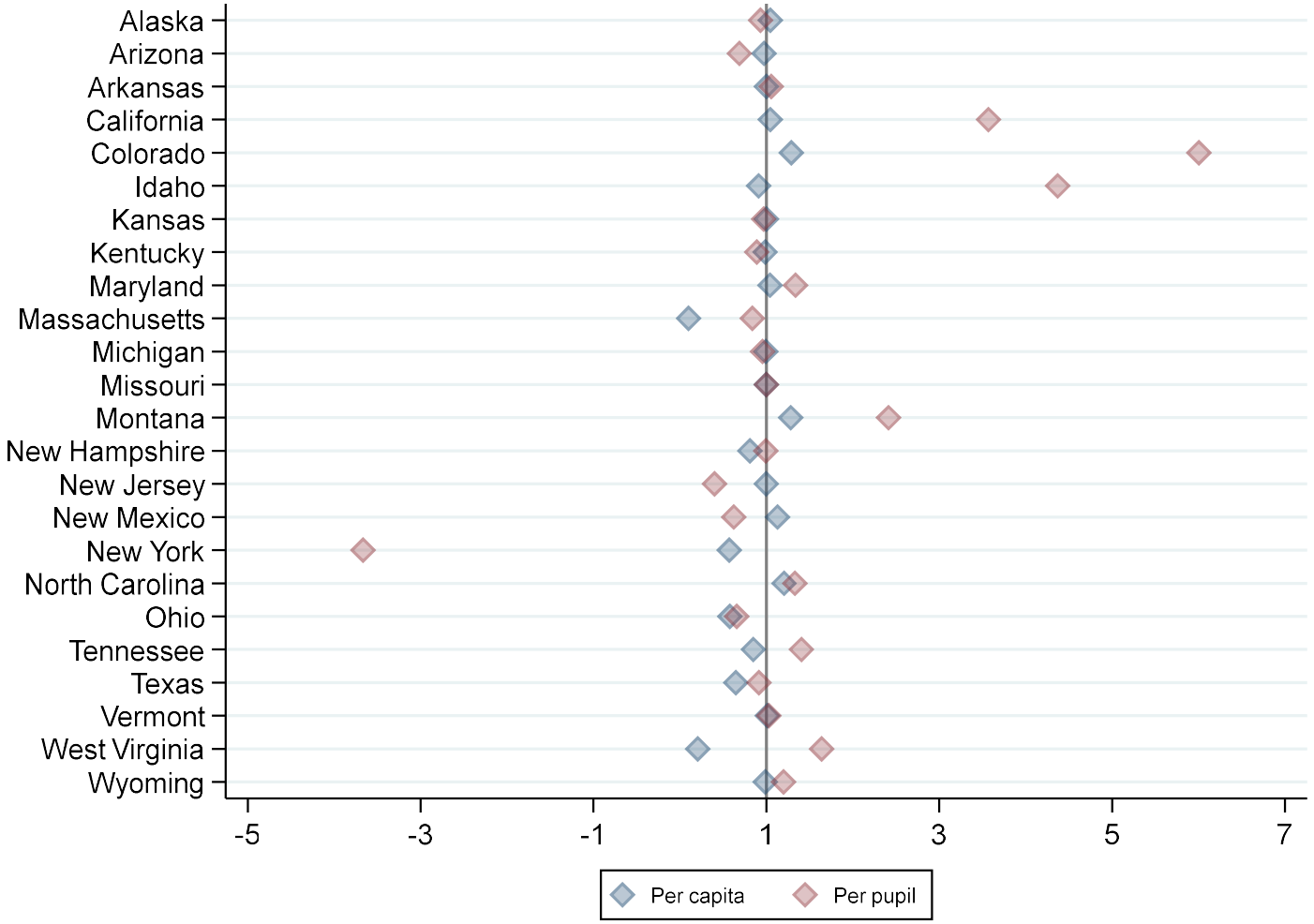
Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Circular markers represent effect estimates and spikes represent 90% confidence intervals. The vertical dashed line denotes the fiscal year of the SFR reform.

Appendix Figure C2. Ridge ASCM percent improvement in pre-treatment model fit, elementary-secondary education expenditures



Notes: The percent improvement in the L^2-norm model fit statistic obtained from the per capita and per pupil elementary-secondary expenditures ridge ASCM models relative to the L^2-norm statistic obtained from models that use equal or SCM weights are shown. The L^2-norm statistic indicates the cumulative pre-treatment effect size deviation from zero. A percent improvement value that is closer to 0% indicates that a ridge ASCM model has similar pre-treatment fit as models that use equal or SCM weights. A percent improvement value that is closer to 100% indicates that a ridge ASCM model has better pre-treatment fit than models that use equal or SCM weights.

Appendix Figure C3. Sensitivity of average elementary-secondary expenditure effect estimates to different values of the penalty parameter, λ^r



Notes: Each diamond represents the median $\widehat{effect}^{ratio}$ for a state and outcome (per capita or per pupil elementary-secondary education expenditures). $\widehat{effect}^{ratio}$ is equal to $\widehat{effect}^{L(\lambda)} / \widehat{effect}^{CV(\lambda)}$, where $\widehat{effect}^{L(\lambda)}$ is the average effect estimate for specification L given penalty parameter λ^r, and $\widehat{effect}^{CV(\lambda)}$ is the average effect estimate from my preferred model with a cross-validated λ^r.

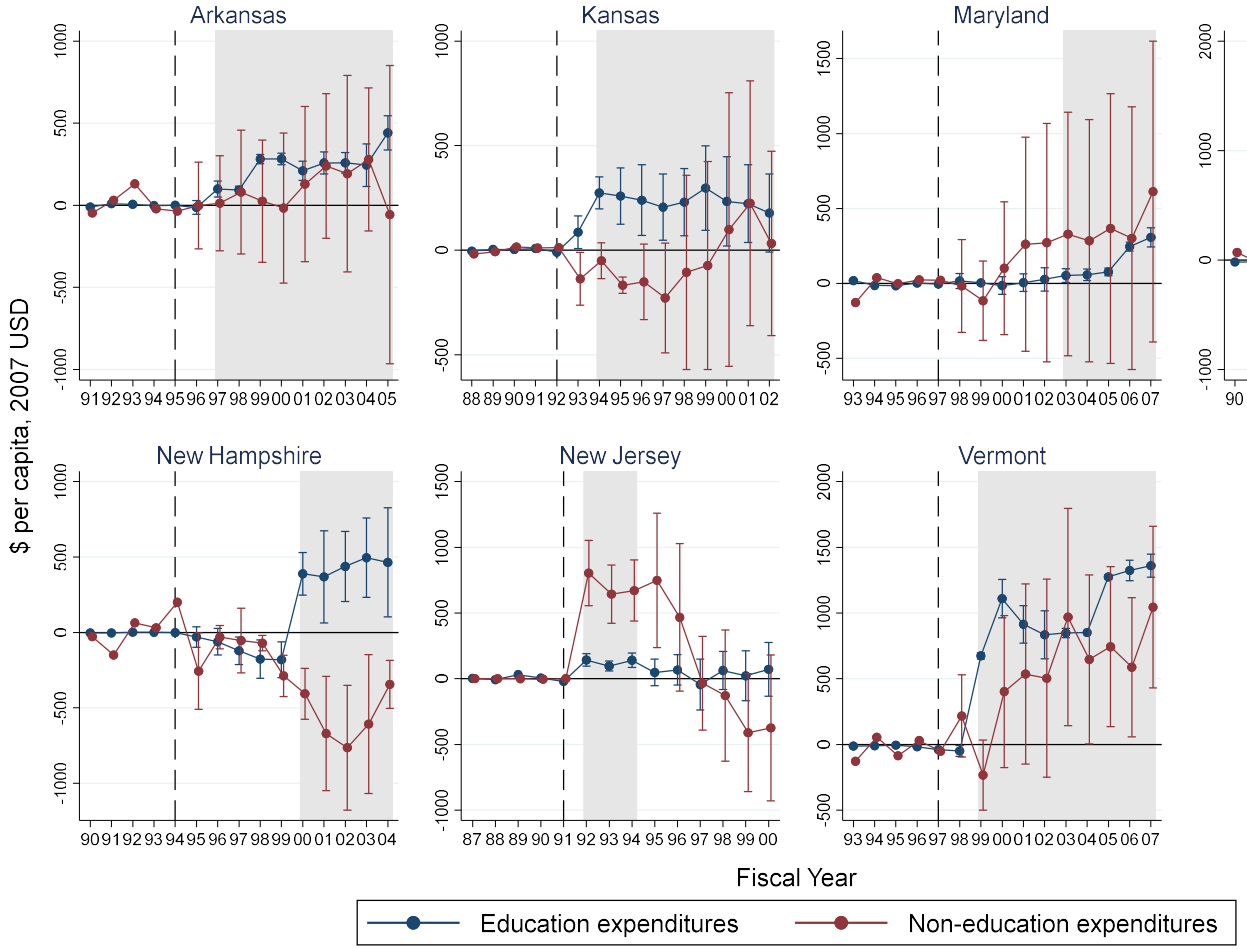
Appendix D. Effect Estimates of SFRs on Non-Education Expenditures and Debt

As mentioned in the "Discussion" section of the main text, I find no legislative evidence that non-education state expenditures were reduced or that state debt was increased to fund increased elementary-secondary education spending following an SFR. However, one may wonder if I find no evidence of reduced non-education expenditures or increased debt because such things just aren't mentioned in legislative statutes related to increasing education funding (either because they're not required to be mentioned like raising revenues are or because doing so might have negative ramifications). Because this may certainly be the case, I sought out further evidence through estimating the effects of the seven state SFRs included in the selected analytic sample on per capita non-education state expenditures and total state debt outstanding using ridge ASCM. Non-education state expenditures include all state expenditures besides expenditures on elementary-secondary education (e.g., expenditures on health and hospitals, higher education, highways, corrections, and welfare are included in non-education state expenditures).

As shown in Figures D1 and D2, I do find some quantitative evidence that non-education state expenditures were reduced and that state debt increased in the years following an SFR in a few states. Namely, New Hampshire experienced decreases in non-education state expenditures relative to its synthetic counterfactual in the same years (2000-2004) that education expenditures increased post-SFR. Kansas, Michigan, New Jersey, and Vermont also experienced imprecise increases in total state debt outstanding in similar years as education spending increased following their SFRs. However, it is difficult to determine whether such changes in non-education expenditures and debt were actually the result of SFRs or some other event or policy change that occurred at the same time. Given that a multitude of events and policy changes

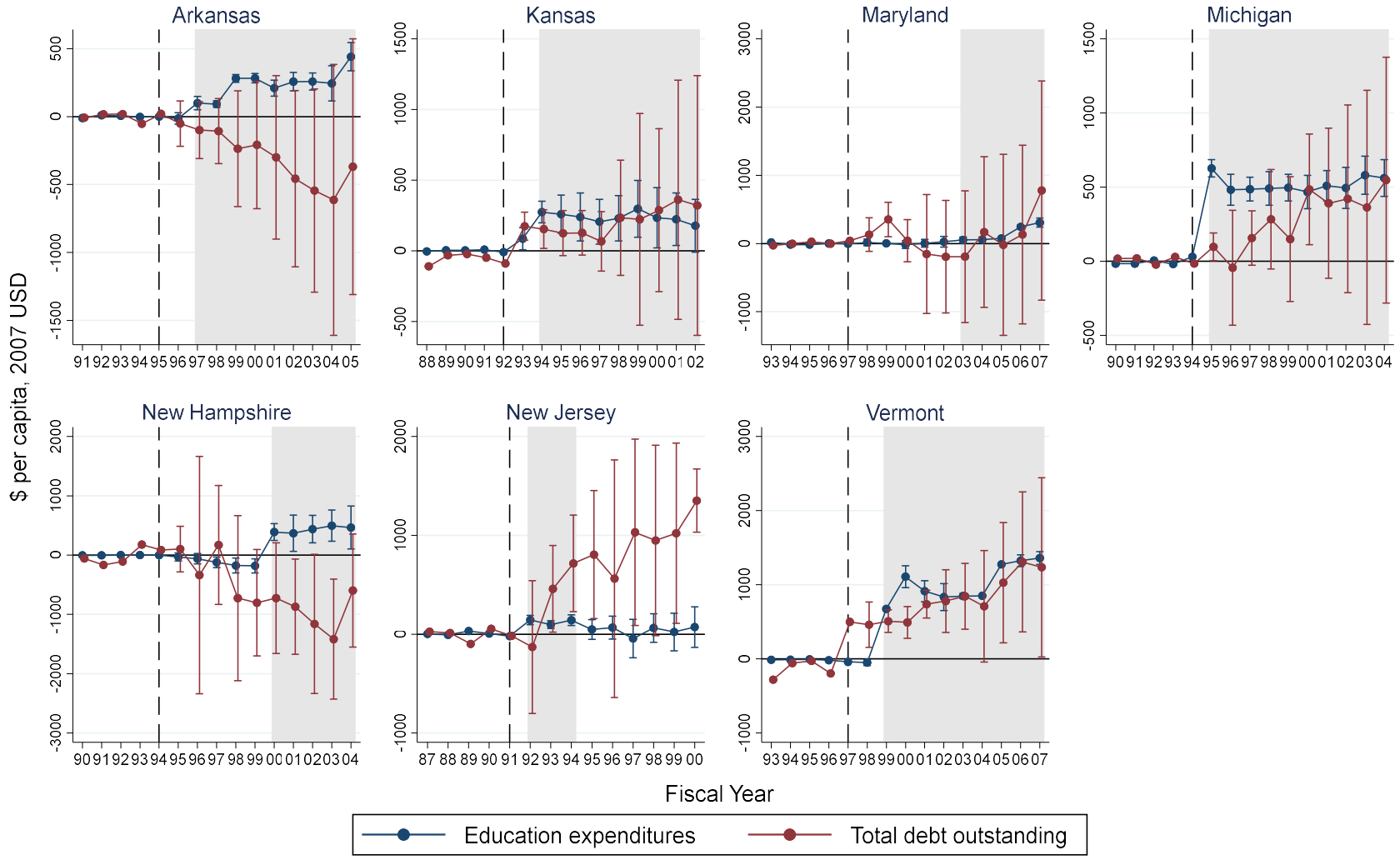
related to state revenues and expenditures occur every fiscal year, I sought to verify or corroborate these quantitative findings using other sources of information (e.g., academic journal articles, news articles, published briefs or reports). I read through all accessible sources of information I could find related to each of the state SFRs and state finances in New Hampshire, Kansas, Michigan, New Jersey, and Vermont. In short, I never found credible evidence of any kind indicating that non-education state expenditures were reduced or that state debt was increased to fund SFRs. Without additional corroborating evidence, I am not confident that the effects on non-education expenditures and state debt (shown in Figures D1 and D2) should rightly be attributed to SFRs. As such, I recommend further examination into whether SFR-induced increases in state education spending impacts the funding of other state priorities or state deficits.

Appendix Figure D1. Ridge ASCM effect estimates of SFRs on per capita education and non-education expenditures



Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Non-education state expenditures include all state expenditures besides expenditures on elementary-secondary education (e.g., expenditures on health and hospitals, higher education, highways, corrections, and welfare are included in non-education state expenditures). Circular markers represent effect estimates and spikes represent 90% confidence intervals. The vertical dashed line denotes the fiscal year of the SFR reform. Grey background shading indicate years in which per capita education expenditures significantly increased at the $p < .10$ level.

Appendix Figure D2. Ridge ASCM effect estimates of SFRs on per capita education expenditures and total debt oustanding



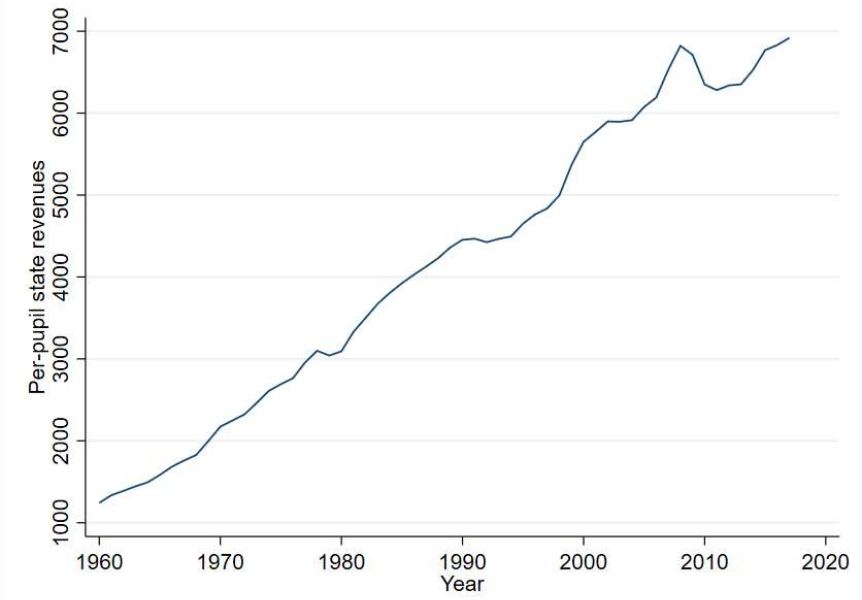
Notes: Ridge ASCM effect estimates for each state-year relative to its counterfactual are shown. Circular markers represent effect estimates and spikes represent 90% confidence intervals. The vertical dashed line denotes the fiscal year of the SFR reform. Grey background shading indicate years in which per capita education expenditures significantly increased at the $p < .10$ level.

CHAPTER 2

Changes and Trends in State Elementary-Secondary Education Funding Among States, 1960-2017

State investments in public elementary-secondary education (i.e., pre-kindergarten through grade 12) have steadily increased over time. On average, in real 2017 dollars, states contributed approximately $1,200 in revenues per pupil in 1960, $5,600 per pupil in 2000, and $6,900 per pupil in 2017. As shown in Figure 1, average state funding per pupil has consistently increased by about $1000 every decade (besides a notable dip in funding around 2010 due to the Great Recession), suggesting there is a long-term, positive trend in state investments in elementary-secondary education.

Figure 1. Average per-pupil state elementary-secondary education revenues over time



Notes: Real dollar values are presented in 2017 USD. Data was compiled from various sources; see Appendix A for further details.

Surprisingly, little else is known about *state-specific* changes and long-term trends in state elementary-secondary education spending over the past sixty years. Have some states increased education investments by $10,000 per pupil, while others have only increased state education by $1,000 per pupil? We also don't have a clear picture of volatility in state-specific trends in state education funding over time. Do most states' trends in education spending look like the smoothly increasing average state revenues trend shown in Figure 1? Or are most states' trends in education spending volatile with periods of growth, decline, and/or stagnation? State education spending has been shown to exhibit volatility, especially around the time of economic recessions when state income and sales tax revenues (which largely fund state education spending) are down (Biolsi et al., 2021; Evans et al., 2019; Jackson et al., 2021; Shores & Steinberg, 2019a).

Our lack of knowledge about state-specific changes and trends in state education spending due, in part, to the challenges of collecting and compiling 50+ years of finance data across fifty states. The National Center for Education Statistics [NCES], which provides information on public elementary and secondary schools via its Common Core of Data [CCD] database, only provides state-level finance data as far back as the 1986-87 school year. Yet, the importance of collecting and analyzing consistent school funding data over a long period of time is crucial to understanding many basic questions about state education investments.

Policymakers and researchers should care about changes and trends in state education funding for a variety of reasons. First, given that increases, as well as decreases, in education funding have been shown to impact a host of student outcomes (Jackson, 2020; Jackson et al., 2021; Jackson & Mackevicius, 2021; Shores & Steinberg, 2019b), understanding state-specific changes and trends in state education investments could help to contextualize and describe long-

term trends in student achievement and other education-related outcomes. Second, understanding trends, changes in trends, and shocks in state education investments among states could help with identifying policy changes or events are motivating increases in state education funding over time. Third, analyzing changes and trends in state education funding also has implications for understanding whether funding for elementary-secondary schools is adequate. Thus, examining changes and trends in state education revenues is relevant for education policy discussions.

In this essay, I investigate changes and trends in per pupil state education investments among states from 1960 to the present. To examine state education investments prior to the late 1980's, my colleagues and I collected and hand-entered state revenues and student enrollment data from US Department of Education [DOE] and NCES series reports dating back to the early 1960's.[44] I computed the overall level of change in per pupil state education spending between 1960 and 2017 by state. I also used a Bayesian algorithm to decompose each state education revenue time series to assess trends and changes in trends in state revenues over time. It is important to note that, in conducting these descriptive analyses, my goal is not to provide causal explanations regarding changes in state education funding. Rather, I seek to provoke further discussion about state-specific changes and trends in state education investments, as well as invite further study of the factors or events that are motivating increased state education funding.

The paper proceeds as follows. First, I begin with a brief discussion of state elementary-secondary education funding and the value of examining changes and trends in state education revenues. Next, I describe the data and methods used, followed by the results of my analysis. I conclude with a discussion of my findings and suggestions for future research.

[44] Christopher Candelaria, Kenneth Shores, Augustina Paglayan, and I contributed to the creation of an annual, state-level panel of state education revenues and student enrollment data from 1959-1960 to 2016-17.

Background

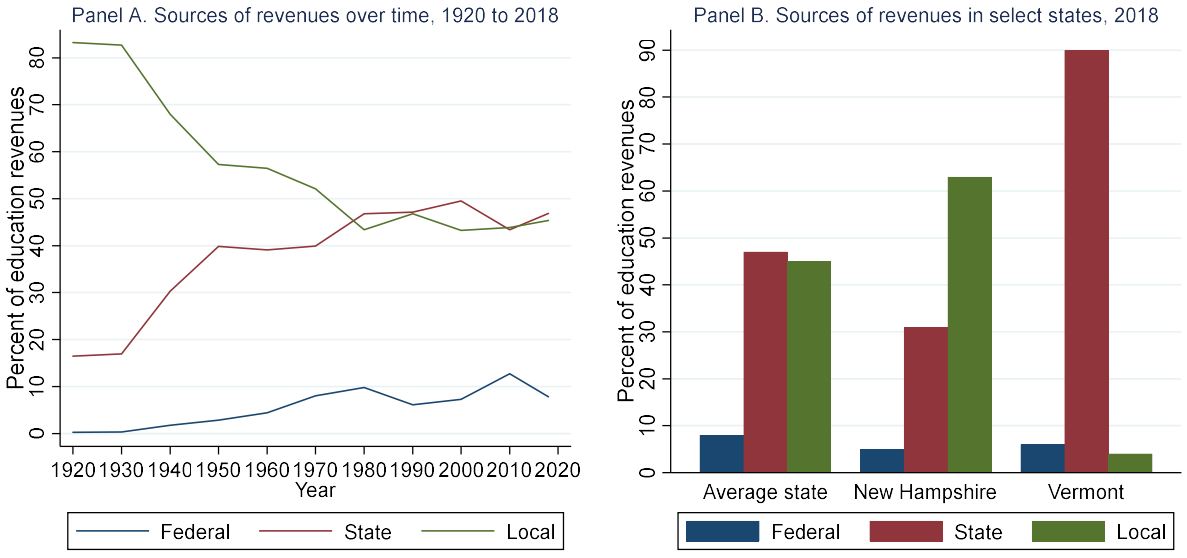
Primer on State Elementary-Secondary Education Funding

Below I provide a brief overview of state elementary-secondary education funding to facilitate understanding of the trends presented and discussed later in the chapter.

What are the sources of funding for elementary-secondary education? The funding of public elementary and secondary schools in the United States involves a combination of local, state, and federal government revenues.

How does state education funding compare to education funding from federal and local sources? In the 1920s, 83 percent of education funding came from local sources and the remaining 17 percent from state sources. By the 2017-18 school year, state governments provided 47 percent of education funding, local governments provided 45 percent, and the federal government provided 8 percent (see Panel A of Figure 2 below). It is important to note,

Figure 2. Sources of elementary-secondary education revenues



Data sources: For Panel A, see NCES (2020); for Panel B, see NCES (2021)

however, that the percent of education revenues that comes from state and local sources varies across states. For example, in the 2017-18 school year, the percent of education funding from state and local sources in New Hampshire was 31 percent and 63 percent, respectively. In contrast, 90 percent of education funding came from state sources and 4 percent from local sources in Vermont (see Panel B of Figure 2).

What is the basis for state investment in education? Every state in the nation has a legal obligation to operate and maintain a public elementary-secondary education system under their respective state constitutions. However, there is variation across states in the specific wording used in constitutions to describe public schooling obligations, which has consequences for how schools are funded in each state (Dallman & Nath, 2020). Some state constitutions only require the establishment of a "free" or "common system" of education. Other state constitutions include more prescriptive wording in their education clauses, such as "uniform", "efficient", "equal rights", and "high-quality education". Some state constitutions also have specific provisions on education funding related to dedicated revenue sources, increasing revenues to raise funding for education, and equitable allocation of funds (Dallman & Nath, 2020). For a description of the language on public school funding included in each state's constitution, see Parker (2016).

How is the level or amount of state funding dedicated to elementary-secondary education determined? State investments in elementary-secondary education are dictated by a school funding formula that is approved and enacted by the state legislature. These formulas generally determine the amount of funding or aid the state is expected to contribute on a per-pupil basis after taking into consideration funds received from local sources. New state education funding can be distributed such that per pupil funding increases for all students statewide or such that funding primarily increases for certain districts that face higher costs, such as small districts in

remote areas or those that serve a higher number of students with additional needs (e.g., English Language Learners, students with disabilities, or students from low-income households) (Baker & Corcoran, 2012; Chingos & Blagg, 2017).

How much money do states dedicate to elementary-secondary education? As of the 2019-20 fiscal year, state governments collectively spent $430 billion on elementary-secondary schooling. Elementary-secondary education is the second largest category of state funding, comprising 19 percent of total state expenditures (National Association of State Budget Officers, 2020).

What are the sources of state revenues for education? State revenues for elementary-secondary education are raised from a variety of sources, including personal and corporate income taxes, retail sales taxes, "excise" taxes such as those on alcohol and tobacco products, and state lotteries (Skinner, 2019).

Why Study Changes and Trends in State Education Funding?

Analyzing changes and trends in state education revenues over time can increase our understanding in many ways that are of relevance to education researchers and policy makers. First, understanding changes and trends in state education spending over time could support our understanding of long-term trends in student achievement and other education-related outcomes. Arguably, the causal impact of educational spending on student outcomes is one of the most consistent and policy-relevant findings in recent education literature. A meta-analytic review of papers using quasi-experimental variation to identify causal effects indicates that, on average, a $1000 increase in per-pupil school spending maintained for four years increases test scores by 0.04 SD, high-school graduation by 2.1 percentage points, and college enrollment by 3.9 percentage points (Jackson & Mackevicius, 2021). Conversely, a $1,000 reduction in per-pupil

spending is estimated to decrease test scores by 0.04 SDs and lower the college-going rate by 1.24 percentage points (Jackson et al., 2021). Given the link between education funding and student outcomes, identifying which states have substantially increased or decreased investments in education over time generally or in certain time periods may be beneficial in understanding state-level trends in student achievement and other student outcomes.

Second, analyzing trends in state education investments across states is an important first step in understanding what policy changes or events are motivating increases in state education funding over time. Descriptively analyzing state trends will by no means identify the "causes" of rising state investments in education. Nevertheless, after identifying key time points at which significant shifts in state education funding occur, for example, one could then search for mechanisms associated with rising state investments. A comprehensive description of when shifts in state education investments have occurred, paired with an overview of the policy and policy-related factors motivating such shifts in education funding, would be useful for both policy-makers and researchers. Such information would provide examples of policies that were successful in increasing state education funding and could serve as a guide to state government officials and policy-makers who are currently pursuing or considering altering their state education finance systems.

Third, examining changes in state education funding could serve as an indicator of which states are trying to more adequately fund K-12 schools. Adequate funding can be broadly defined as a sufficient (adequate) level of resources required for students to achieve some educational outcome (Baker & Green, 2015). Since the late 1980s, 23 states have been sued by state citizens for failing to provide students, especially those from disadvantaged backgrounds, with adequate education funding as required under their state constitution. As a result of these lawsuits, some

states have increased the overall level of state spending on public schools, as well as targeted larger spending increases to districts serving economically disadvantaged students, while others have not (Shores et al., 2021). Trends in state education funding could provide additional empirical evidence for assessing state efforts towards improving adequacy in education funding.

Lastly, understanding changes and trends in state education funding could contribute to knowledge regarding overall changes and trends in state budgets. Given that elementary-secondary education has been either the largest or second-largest category of expenditures for most states for the past fifty years,[45] changes in state education investments likely have large repercussions for other state budget categories and priorities. Studies have found that to accommodate spending increases in elementary-secondary education mandated by school finance reforms [SFRs], states have had to raise a variety of taxes (Liscow, 2018; Essay 1 of this dissertation). Thus, trends in state education investments could relate to and possibly explain trends in tax revenues over time. As a result, public policy-makers, government officials, and scholars in other fields may also benefit from an increased understanding of state education funding changes and trends.

Methods

Data

To examine changes and trends in state education investments, I use an annual, state-level panel of state education revenues and student enrollment data from 1959-1960 to 2016-17. For years 1986-87 to 2016-17, revenues and enrollment data were obtained from the National Public Education Financial Survey [NPEFS], which is distributed by the National Center for

[45] Based on author's calculations using the U.S. Census Bureau's Annual Survey of State Government Finances revenue and expenditure data from 1982 to 2017

Education Statistics [NCES]. Revenues and enrollment data from 1959-60 to 1985-86 were obtained from U.S. Department of Education [DOE] and NCES series reports, including *Digest of Education Statistics* and *Statistics of State School Systems*. These reports are the predecessors of NCES' Common Core of Data [CCD]. Data from these reports were hand-entered by either Paglayan (2019) or Candelaria, Shores, and I because the data had not been previously digitized. Further details on the compilation of and sources for the annual panel dataset can be found in Appendix A.

State education revenues are defined as revenues given to districts by the state and include unrestricted grants-in-aid, restricted grants-in-aid, revenue in lieu of taxes, and payments for, or on behalf of, districts.[46] State student enrollment represents the total count of students enrolled in public elementary or secondary schools (in grades pre-kindergarten through grade 12) in the Fall (typically October 1) of the academic year. State education revenues are transformed into 2017 USD using the *cpiget* Stata command (Shores & Candelaria, 2019)[47] and then divided by state student enrollment to provide a per-pupil estimate.

Analytic Approach

My descriptive analysis of trends in state education investments proceeds as follows. First, I calculate the change in per pupil state education revenues between 1960 and 2017 by state, as well as the percent change, to assess the magnitude of growth of state education revenues over the past sixty years. Next, I plot per pupil state education revenues from 1960-2017 by state. Such figures provide a visual depiction of the trends and patterns in state education revenues that have transpired over the last sixty years. However, when visually

[46] Federal revenue distributed by state governments is not included in our measure of state education revenues.
[47] This command transforms nominal to real dollars using an annual average of monthly Consumer Price Index data over the academic year (i.e., July 1 to June 30).

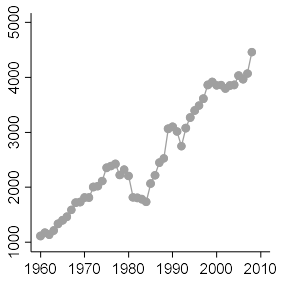
examining state revenues over time, it can sometimes be difficult to identify underlying trends and key time points at which shifts in revenues have occurred due to error in the time series data (this is especially true in the earlier decades of our time series data). As such, I decompose each state education revenue time series using a Bayesian algorithm in order to better assess trends and changes in trends in state revenues over time.

In general, decomposition methods decompose a time series into three model components: time trends, which reflect the long-term progression of the series; intercept or trend changes at specific points in the time series, referred to hereafter as "changepoints"; and random error. However, a large or infinite number of model decompositions based on various algorithms can be applied to any one time series (see Aminikhanghahi & Cook (2017) or Burg & Williams (2020) for an overview of decomposition methods). For example, the trend component alone can be parameterized and approximated by a multitude of linear, piecewise-linear, or polynomial specifications. Decomposition methods that are based on frequentist statistics typically try to choose one so-called "single-best" model from among the infinite number of model decompositions using certain selection criteria, such as Akaike's information criterion (AIC) or the Bayesian information criterion (BIC). Nevertheless, various "best" models can be chosen for the same time series depending on the selection criteria used.

To overcome these issues, I use a Bayesian algorithm for time series decomposition called BEAST [A Bayesian Estimator of Abrupt change, Seasonal change, and Trend] (Zhao et al., 2019). Unlike frequentist methods that choose only a single best model, BEAST is able to synthesize across a large proportion of the almost infinite number of possible model decompositions using a weighted average model. As illustrated in Figure 3, BEAST specifically decomposes a given time series into trend, changepoint, and error components via numerous

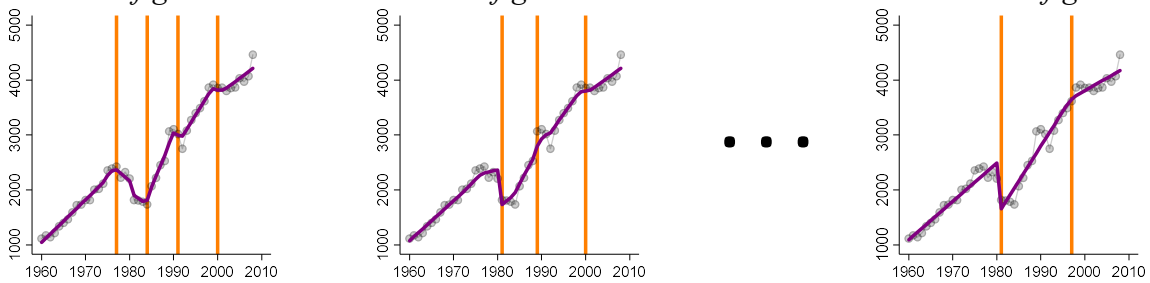
Figure 3. Illustration of rBEAST

Time series of per pupil state revenues



BEAST decomposes the time series into trend & changepoint components via numerous models

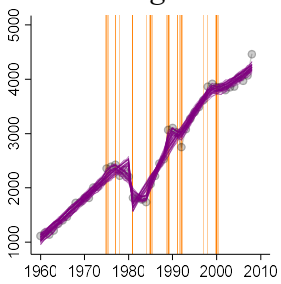
Model Configuration #1 *Model Configuration #2* *Model Configuration #N*



Notes: **trend component=purple line**; **changepoint component=orange line**

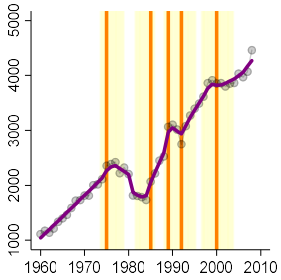
All these models provide useful information about the "true" model; synthesizing across models is often better than choosing a "single-best" model

Model Configuration #1 through Model Configuration #N



BEAST quantifies the usefulness of each model; then combines all models into a weighted average model

Weighted average model



Notes: Confidence intervals associated with changepoints=yellow background shading

Notes: This illustration is modeled after a similar diagram provided in Zhao et al. (2019)

"competing" models.[48] All these models potentially provide useful information about the "true" model; as such, synthesizing these models is often better than choosing a single best model. BEAST quantifies the usefulness of models by assigning each model decomposition a probability of being the "true" model. Then, the BEAST algorithm uses these probabilities as weights to combine all models into one weighted average model. Applying the weighted average model to a given time series, BEAST is able to estimate the fitted trend and changepoint components, as well as estimate confidence intervals associated with the fitted trends and changepoints. Averaging across many models helps BEAST to capture model uncertainty, reduce concerns regarding model misspecification, and improve the modeling of complex data (Zhao et al., 2019).

I decompose each of the fifty per pupil state revenue time series individually using the BEAST algorithm. The unique weighted average model decomposition applied to each time series was synthesized across 5 million "competing" models. I leverage these weighted average model decompositions, including the estimated fitted trend and changepoint components, to descriptively analyze patterns and trends in state education funding over time.

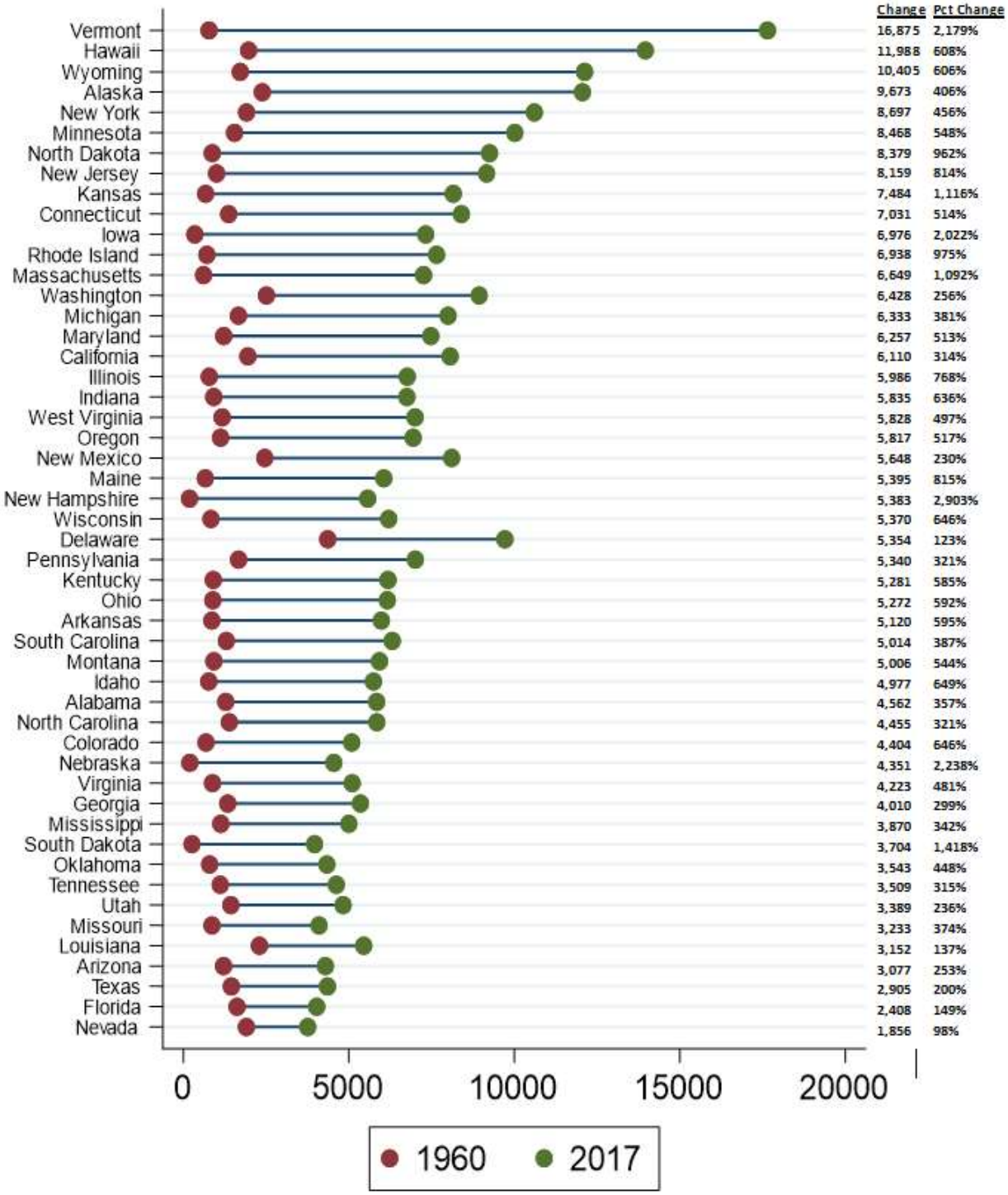
Results

Change in State Education Revenues, 1960-2017

Figure 4 below presents the change in per pupil state education revenues between 1960 and 2017 by state, as well as the percent change over this period. Not surprisingly, all states had higher per pupil revenues in 2017 compared to 1960. As summarized in Table 1 below, median per pupil state revenues amounted to $1,128 in 1960 (in 2017 USD); by 2017, median per pupil

[48] BEAST can also identify a seasonal trend component if desired; however, my data are at the annual level, so I do not use this feature.

Figure 4. Change in state education revenues per pupil, 1960-2017



Notes: Real dollar values are presented in 2017 USD

Table 1. State education revenues per pupil, 1960-2017

	Median	SD	Min	Max
Per pupil state revenues, 1960	1,128	727	185	4,360
Per pupil state revenues, 2017	6,256	2,737	3,758	17,650
Change in per pupil state revenues, 1960-2017	5,362	2,601	1,856	16,875
Percent change per pupil state revenues, 1960-2017	514	577	98	2,903

Notes: Real dollar values are presented in 2017 USD

state revenues were $6,256. The median change in per pupil revenues between 1960 and 2017 was $5,362 (which equates to a 514% increase), with a standard deviation of $2,601. Thus, while every state has increased per pupil funding from 1960 to the present, there is also substantial variation across states in the extent to which revenues increased over the last sixty years.

As one example of this variation, see the per pupil spending changes in Vermont and Nevada displayed in Figure 4. Vermont increased per pupil revenues by $16,875 or 2,179 percent from 1960 to 2017. In contrast, Nevada increased per pupil revenues by only $1,856 or 98 percent between 1960 and the present. To make this comparison another way, Vermont increased per pupil state funding by approximately $300 per year, on average, over the last sixty years. Over the same time period, Nevada increased per pupil funding by roughly $30 per year on average. Thus, some states have increased per pupil state revenues to a much larger degree than others.

Trends in State Education Revenues Over Time

I turn next to considering trends in state education revenues over time by examining the weighted average model decompositions of each state's per pupil state education revenue time series, shown in Figure 5 below.[49] Similar to how the model decompositions were depicted in

[49] Non-decomposed plots of per pupil state education revenues from 1960-2017 for each of the fifty states are displayed in Appendix Figure B1.

Figure 5. Weighted average model decompositions of per pupil state revenues time series by state, 1960-2017

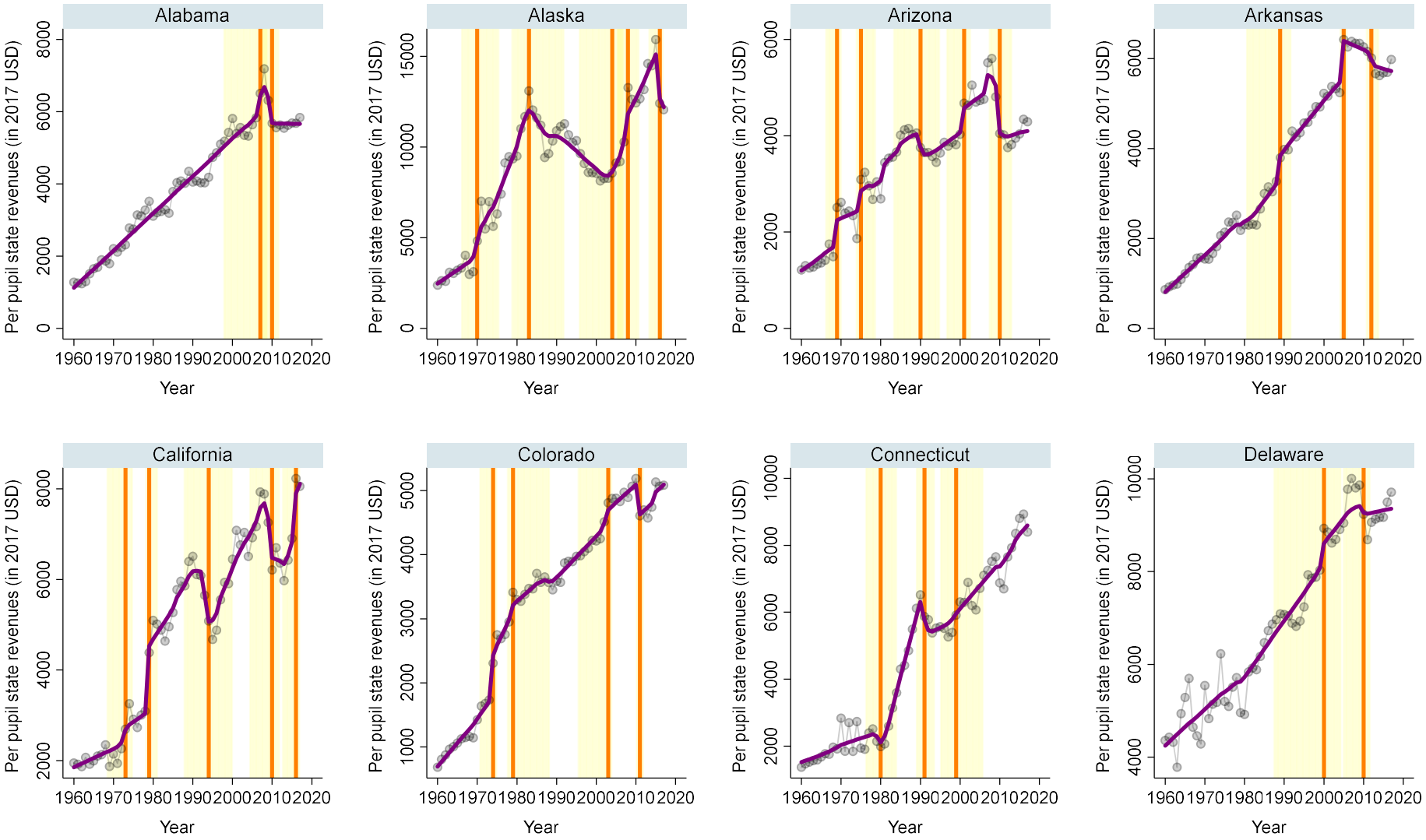


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Figure 5. Weighted average model decompositions–continued from previous page

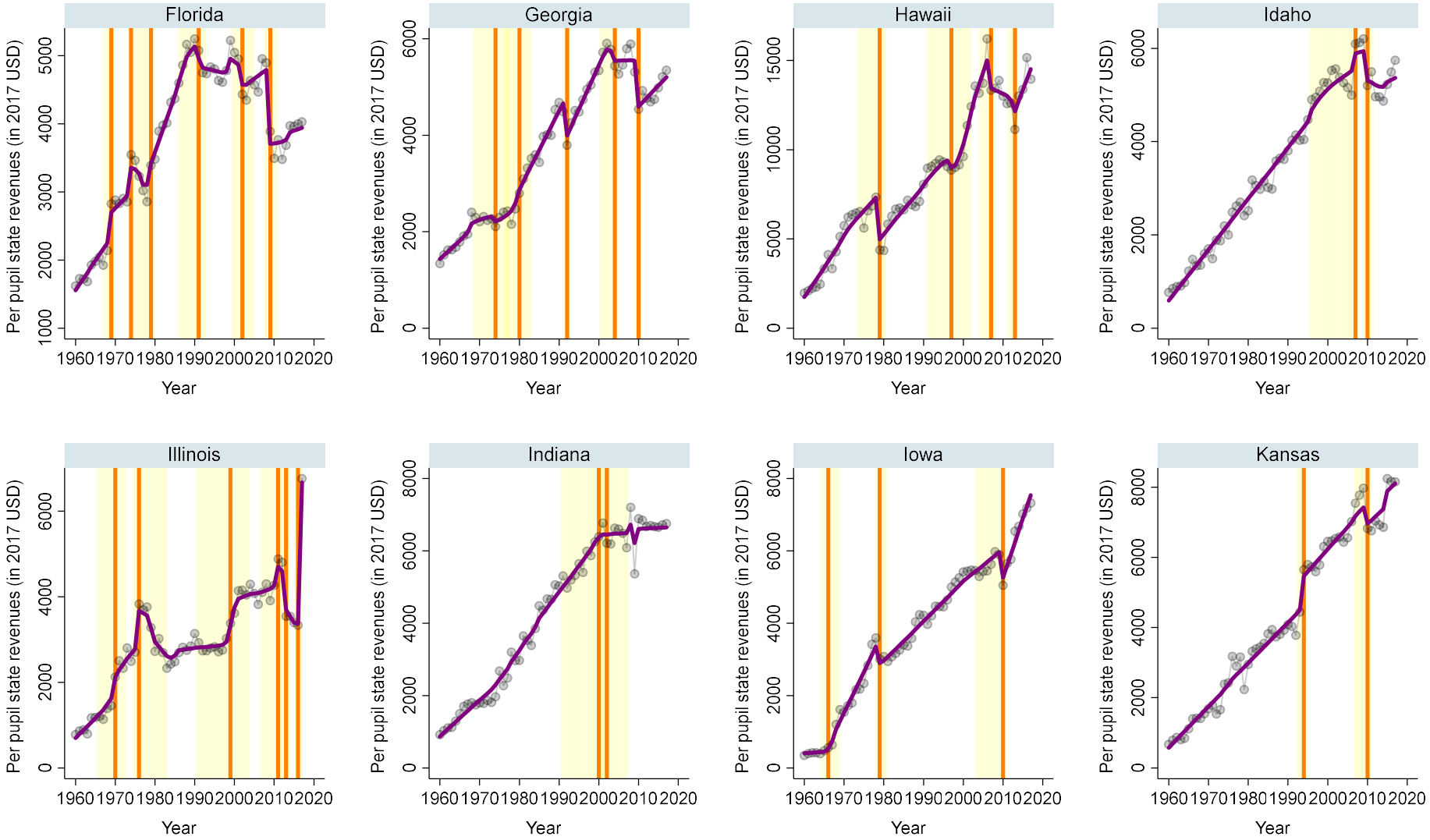

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Figure 5. Weighted average model decompositions–continued from previous page

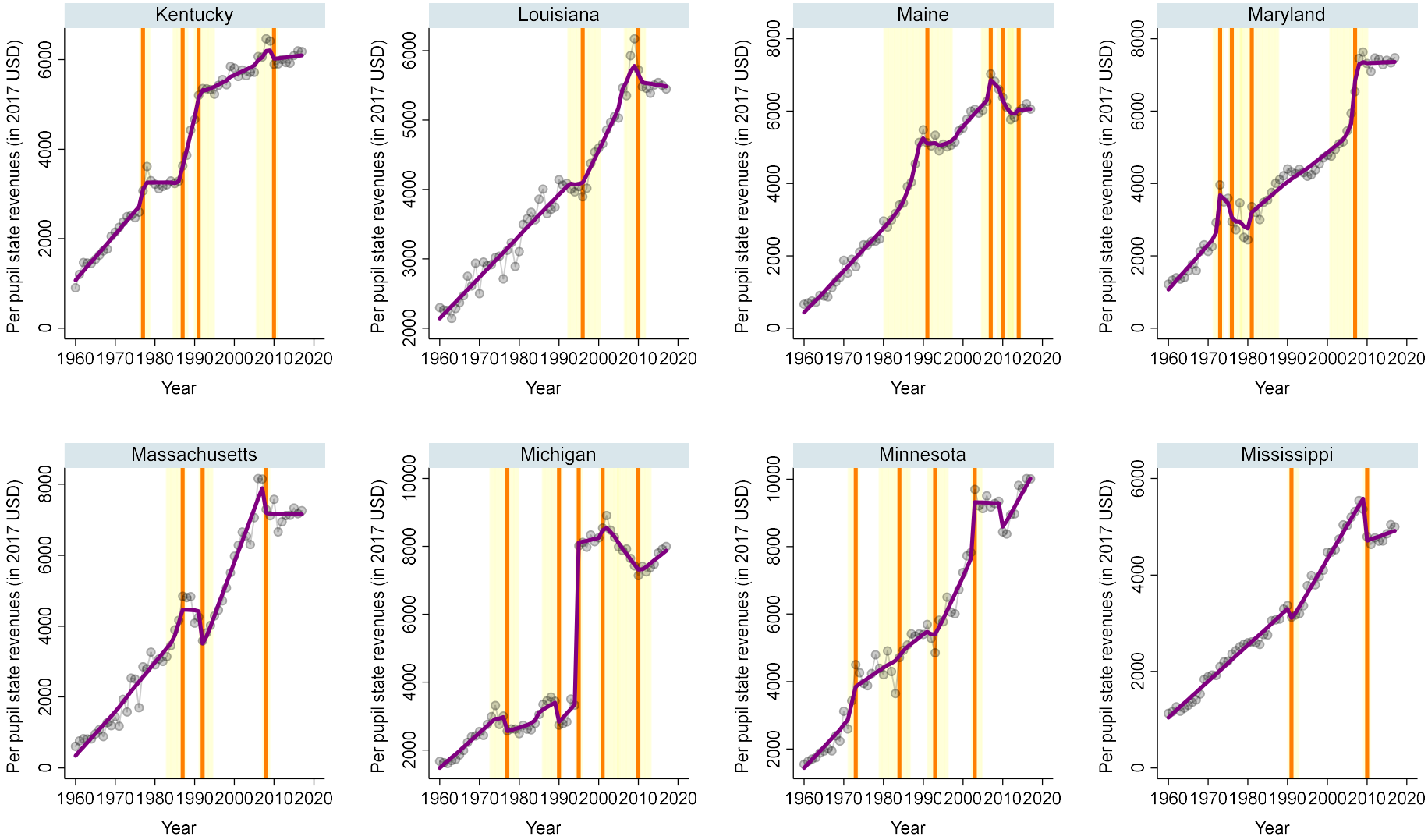

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Figure 5. Weighted average model decompositions–continued from previous page

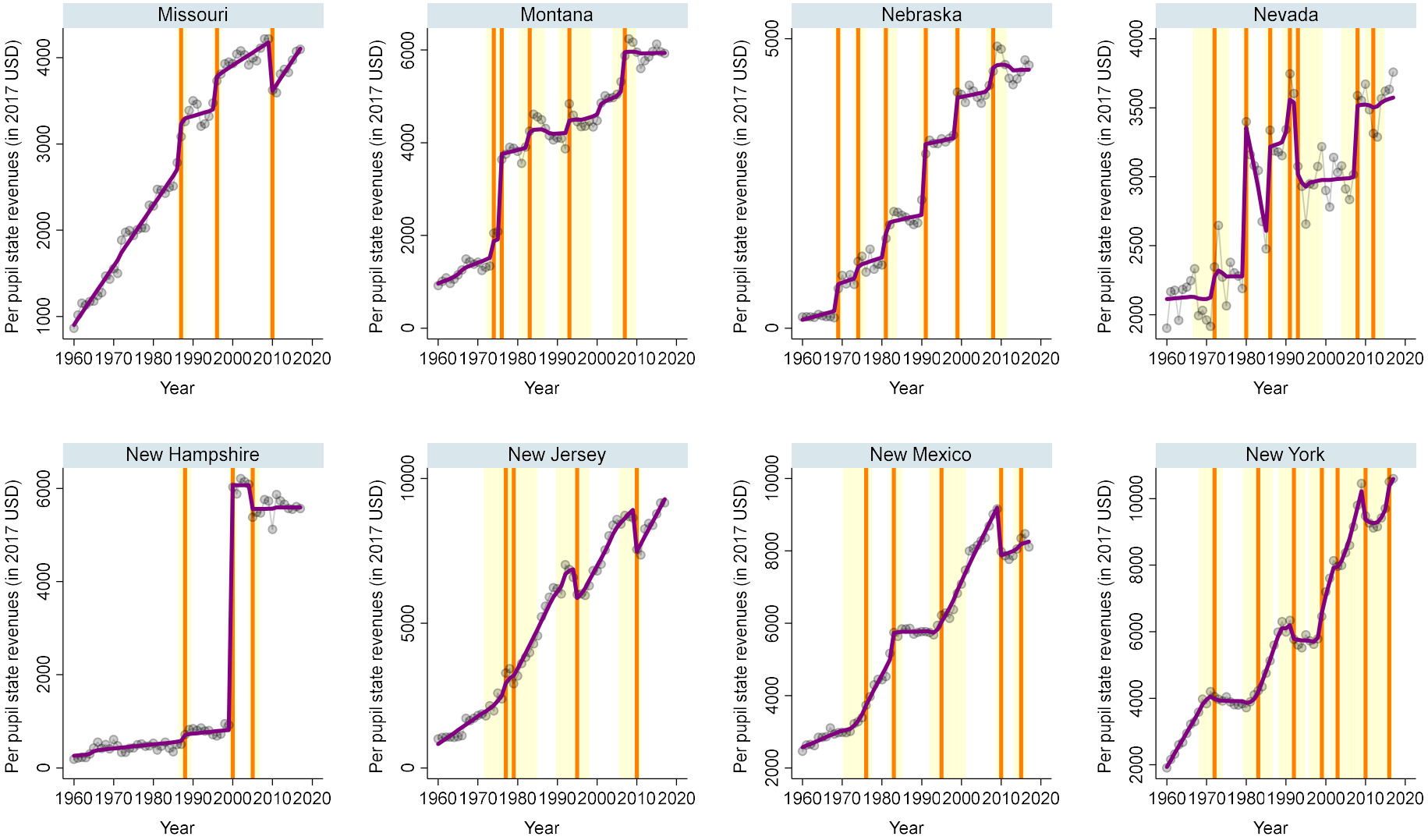

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Figure 5. Weighted average model decompositions–continued from previous page

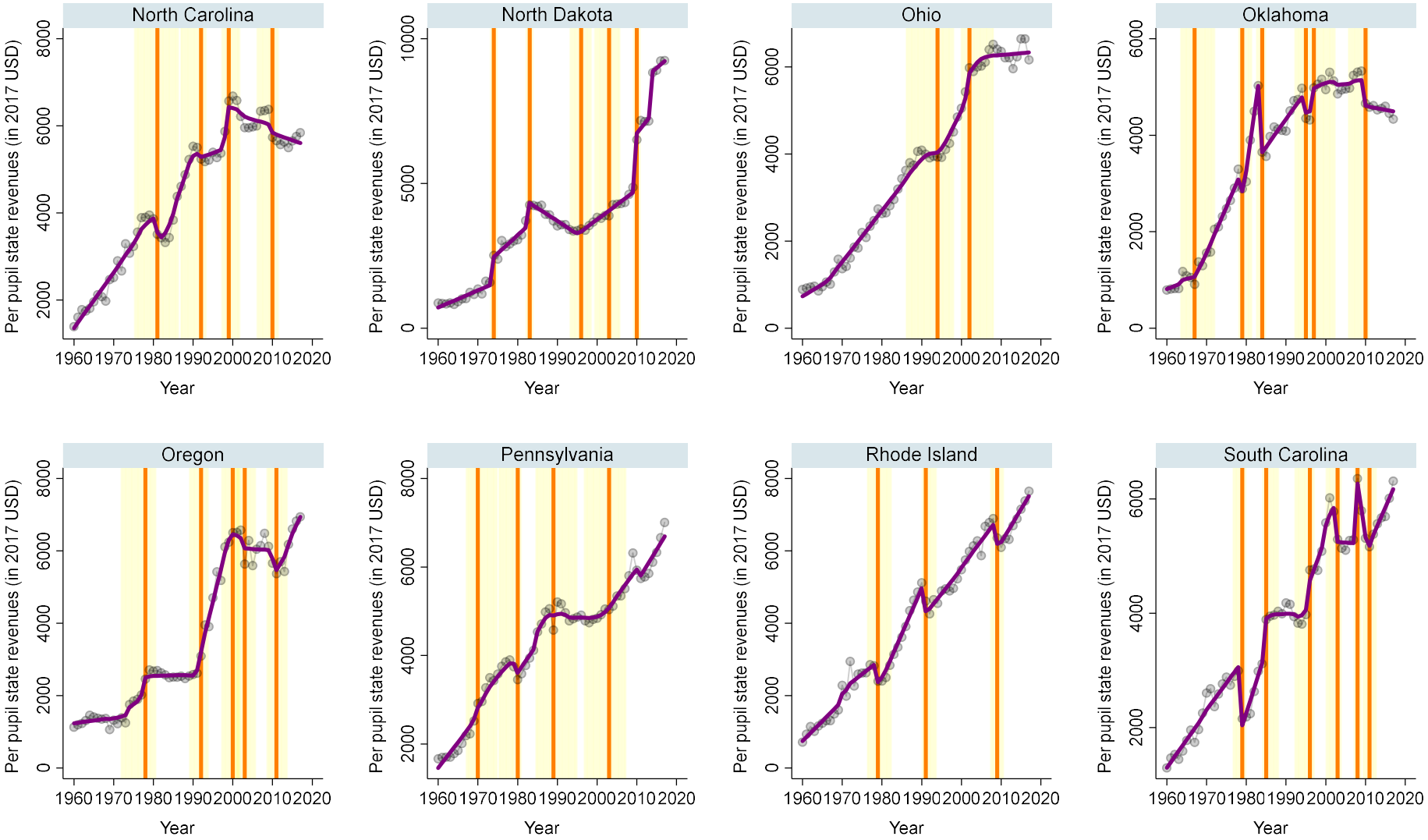

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Figure 5. Weighted average model decompositions–continued from previous page

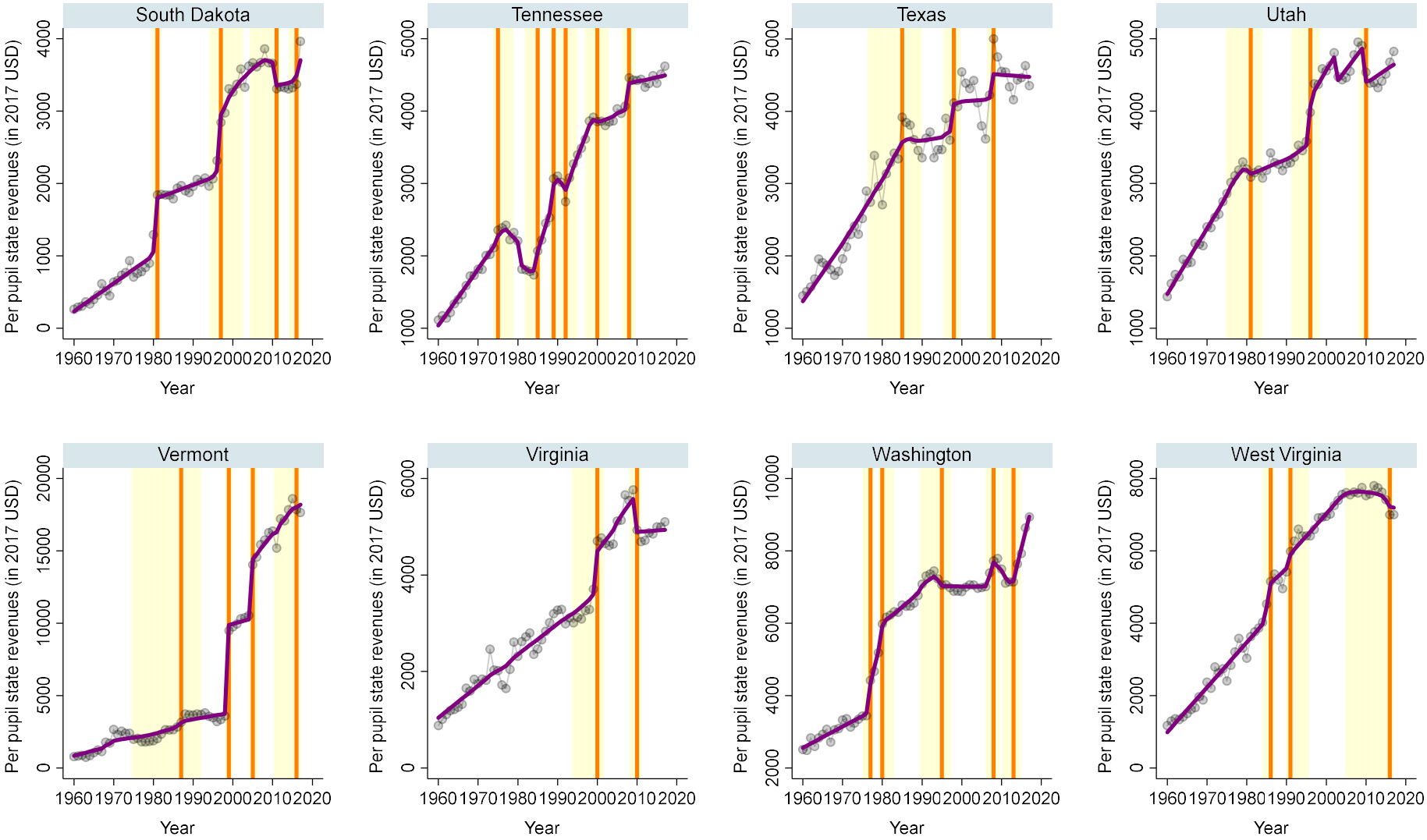

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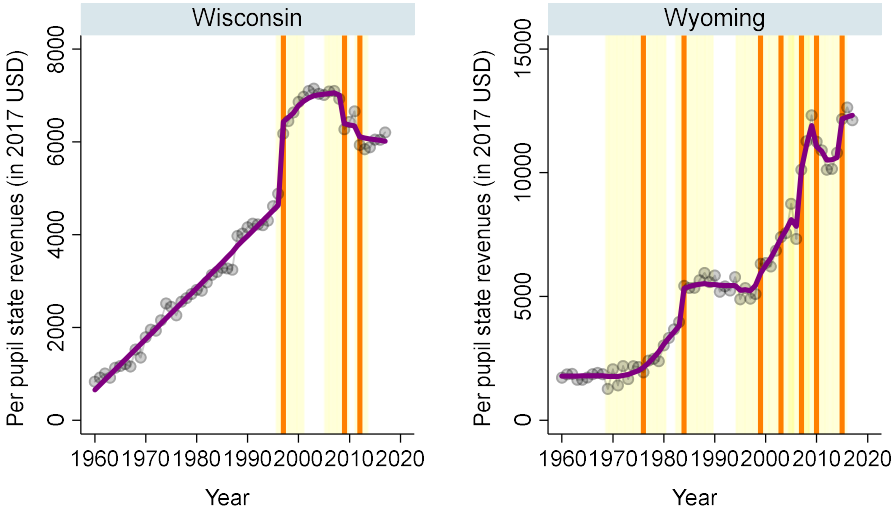
Figure 5. Weighted average model decompositions–continued from previous page



Notes: Weighted average model decompositions were estimated by the Bayesian BEAST algorithm. In each panel, the grey dots indicate per pupil state education revenues and the purple line indicates the estimated trend over time. Orange vertical lines represent estimated trend changepoints (i.e., points at which the trend line deviates from its prior trajectory), and yellow background shading represents confidence intervals associated with the trend changepoints.

Figure 3, the grey dots in each panel indicate per pupil state education revenues and the purple lines indicate estimated trends over time. Orange vertical lines represent estimated trend changepoints (i.e., points at which the trend line deviates from its prior trajectory), and yellow background shading represents confidence intervals associated with the trend changepoints.

Broadly, across all state time series, we see clear evidence of an upward trend in per pupil state revenues from 1960 to 2017. A small minority of states increased per pupil state revenues at roughly the same rate for over fifty years (i.e., from 1960 up to the Great Recession). Examples of such consistent increases can be seen in Alabama's and Idaho's time series, shown in Figure 5. Both of these states steadily increased per pupil revenues by an average of $110-120 per year between 1960 and the late 2000's.

However, the vast majority of state time trends do not follow such a clear-cut linear trajectory. Notably, some states experienced long periods of relative stability in per pupil revenues, interspersed with abrupt increases. For example, New Hampshire's per pupil state revenues were relatively stable from the mid-1960's until around the year 2000, when their per pupil state revenues suddenly jumped from approximately $1000 per pupil in 1999 to $6000 per pupil in 2000 (see Figure 5). Thereafter, from 2000-2017, New Hampshire's per pupil state revenues remained around $6000 (though there is evidence that a drop in funding occurred in 2010). Nebraska's trend in per pupil funding exhibits a similar pattern of periods of stasis, interjected with abrupt increases in funding.

Other states increased per pupil state revenues at varying rates during different periods of time, as well as experienced periods of decline and stagnation in revenues. For example, see Nevada's and North Dakota's time series. While both Nevada and North Dakota increased per pupil revenues between 1960 and 2017, both states experienced prolonged declines and

stagnations in per pupil state revenues during this sixty-year period, which were subsequently offset by periods of rising revenues or significant jumps in funding over the course of one year. Such time series exhibit a nonlinear process of increasing per pupil state revenues.

In addition to heterogenous trends in state revenues over time among states, we also see variability in the number of trend changepoints identified and in the timing that changepoints occur. Table 2 below summarizes the number of trend changepoints detected in each state time series. On average, the BEAST algorithm identified four trend changepoints per state time series. Three states' time series exhibited as many as seven trend changepoints (the maximum number of changepoints detected), while nine states' time series exhibited only two changepoints (the minimum number of changepoints detected). Such variation in the number of identified changepoints further suggests that per pupil state revenues have followed a more consistent trend over time in some states than others.

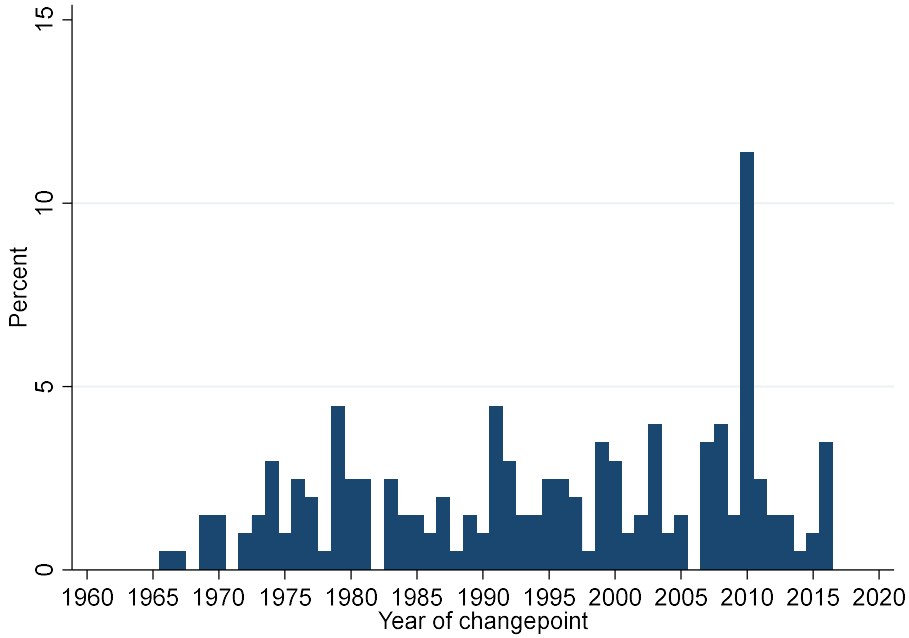
Table 2. Number of trend changepoints identified in decompositions of state time series

# of changepoints	2	3	4	5	6	7
	Alabama	Arkansas	Colorado	Alaska	Florida	Nevada
	Delaware	Connecticut	Hawaii	Arizona	Illinois	New York
	Idaho	Iowa	Kentucky	California	Nebraska	Wyoming
	Indiana	Massachusetts	Maine	Georgia	Oklahoma	
	Kansas	Missouri	Maryland	Michigan	South Carolina	
	Louisiana	New Hampshire	Minnesota	Montana	Tennessee	
	Mississippi	Rhode Island	New Jersey	New Mexico		
	Ohio	Texas	North Carolina	North Dakota		
	Virginia	West Virginia	Pennsylvania	Oregon		
		Wisconsin	South Dakota	Washington		
			Utah			
			Vermont			
			Wyoming			
# of states	*9*	*10*	*12*	*10*	*6*	*3*

Further, Figure 6 on the next page plots the years in which trend changepoints occurred between 1960 and 2017 across the fifty states. A dramatic spike in changepoint occurrences is

apparent in the year 2010—roughly 11% of changepoints occurred during this year alone. When examining individual states' model decompositions, one can see that changepoints in 2010 often coincide with a negative trend deviation (i.e., a downturn in the trend). As such, I suspect that the majority of changepoints that occurred in 2010 (and adjacent years) likely reflect the cuts to state education budgets that are widely known to have taken place in the wake of the Great Recession.

Figure 6. Years of trend changepoints identified in state time series decompositions



Setting aside the spike in changepoints in 2010, changepoint occurrences tend to be widely distributed across the sixty-year time frame. At least one changepoint occurred in 50 of the 53 years (94%) between 1965 and 2017, with a maximum of 4 percent of changepoints occurring in any given year (disregarding the 2010 year).[50] This suggests that deviations in per

[50] Identifying trend deviations at the beginning of a time series is difficult due to the scarcity of trend data to compare against. This likely explains why I don't find any changepoints in the initial years (1960-65) of the per pupil state revenues time series data. Further, I do not tend to find trend changepoints in years that data was estimated using linear interpolation (for further details on missing/interpolated data, see Appendix A). Given these limitations, I acknowledge that additional trend changepoints could have potentially occurred beyond those shown in Figure 6.

pupil state funding have been occurring on a regular basis for the last sixty years and are not confined to any particular era or decade. Further, the fact that changepoints did *not* tend to occur in the same years across state time series implies that changepoint occurrences are highly state-specific. Thus, I suspect that deviations or shifts in per pupil state education funding are often motivated by state-specific policy changes or events.

Discussion

The findings of this study are as follows. First, every state has increased their per pupil funding of education between 1960 and 2017. However, the degree to which states increased per pupil state education revenues varies considerably across states (percent change in revenues ranged from 98% to 2,093%), suggesting that some states have prioritized increasing their investments in education more than others. Second, trends in state education revenues over the last sixty years also exhibit heterogeneity among states. While a handful of states have steadily and consistently increased per pupil state revenues over time, the majority of states have followed a nonlinear process of increasing per pupil state revenues that is interspersed with periods of decline and stagnation. Lastly, there is also variability in the number and timing of trend changepoints that occur throughout each state time series, which further suggests that each state is following their own unique path or trend in increasing state revenues. Taken together, this paper provides novel evidence of substantial heterogeneity in how states have increased education funding over time.

There are several limitations to the descriptive analysis provided in this dissertation essay. Namely, the findings of this study only speak to changes and trends in *state* education revenues over time, not *total* education revenues. Thus, increases in per pupil state education revenues across all states does not necessarily imply that total education revenues also increased

over time in all states. Future studies should build upon this work and examine trends and changes in total education revenues over time. Further, the analysis focuses on changes and trends in per pupil state revenues at the state level, not the district level (because district-level state funding data is not available on an annual basis back to the 1960's). As such, I cannot speak to whether per pupil state revenues are being distributed more equitably to districts over time, though I acknowledge that issues of adequacy and equity are both important to consider when examining education funding.

As my results make clear, the degree to which state education funding increased over the past sixty years varies considerably by state. Although some of this variation may reflect broader economic differences between states or differences in the size of student populations between states, it likely also reflects policy differences in how education is funded across states. As mentioned in the background section of the paper, state policies dictate which revenue sources are used to fund education. State policies also determine state school funding formulas and how much local governments/districts are expected to contribute towards education. To fully understand changes in state education revenues over time, we likely need further research into how state-level policies regarding education funding have changed over time.

Although I do not attempt to provide a causal explanation for why state education revenues have been increasing over the past sixty years, the trend changepoints identified in this study could prove useful in such efforts. Specifically, because such changepoints identify key time points at which significant shifts or deviations in state education funding occur, one could then search for policy changes or events that were associated with rising state investments that took place around the same time. A comprehensive description of when shifts in state education investments have occurred, paired with an overview of the policy and policy-related factors

motivating such shifts in education funding, would be useful for both policy makers and researchers. Ultimately, this analysis should encourage further discussion about state-specific changes and trends in state education investments and further study of the events that are motivating increased state education funding.

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Appendix A. Data Sources

Christopher Candelaria, Kenneth Shores, Augustina Paglayan, and I compiled an annual panel of state education revenues and student enrollment data from 1959-1960 to 2016-17. A detailed overview of original sources of the data and which individual(s) hand-entered data for each year of the panel can be viewed in Appendix Tables A1 and A2.

For years 1986-87 to 2016-17, we obtain revenues and enrollment data from the National Public Education Financial Survey (NPEFS), which is distributed by the National Center for Education Statistics (NCES) and is easily accessible online.[1] Revenues and enrollment data from 1959-60 to 1985-86 were obtained from U.S. Department of Education (DOE) and NCES series reports, including *Digest of Education Statistics* and *Statistics of State School Systems*. These reports are the predecessors of NCES' Common Core of Data (CCD). Data collection for these reports typically proceeded as follows, as described in the data appendix of Paglayan (2019):

> "The DOE (and its predecessor, the U.S. Office of Education) mailed out to each state a common questionnaire, as part of an initiative known as *The Common Core of State Educational Information.* The states had previously obtained the data from their respective local school districts which, in turn, based their reports on data furnished by administrative, instructional, and other employed personnel. Each completed state questionnaire was carefully reviewed by the DOE for mathematical accuracy, internal consistency, and general adherence to prescribed definitions and terminology. The data were then compared to those of previous years and when questions arose, follow-up letters were sent to the corresponding state requesting an explanation" (pg. 2 of data appendix).

Thus, most data from these reports represent *actual* state revenues and student enrollment counts. However, for a few years (1962-63, 1966-67, 1968-69, 1970-71, 1972-73), state education revenues reported in the DOE/NCES reports were *estimated* and obtained from the National Education Association's *Estimates of School Statistics* reports.

[1] See https://nces.ed.gov/ccd/stfis.asp

Data from the DOE/NCES reports were hand-entered because they had not been previously digitized. Student enrollment counts were entered by Paglayan (2019), and state education revenues were hand-entered by either Paglayan (2019) or Candelaria, Shores, and McNeill (see Appendix Table A1 for which years of data were hand-entered by which individuals). Paglayan (2019) followed standard procedures "to ensure the accuracy of the hand-entry process (e.g., calculating column totals and comparing them to the totals reported in the printed reports, graphing individual time series to check for abnormalities, etc.)" (data appendix, pg. 2). The authors followed similar procedure as Paglayan (2019) when verifying the accuracy of their hand-entered data.

State education revenues data is missing for all states in years 1960-61, 1964-65, and 1981-82. Additionally, Wisconsin is missing state education revenues in 1977-78; Alaska, Georgia, Illinois, and Wisconsin are missing state education revenues in 1978-79; and Virginia is missing state education revenues in 1985-86, 1986-87, and 1987-88. After viewing graphical depictions of state-specific trends, we chose to estimate any missing years through linear interpolation using data from the year prior and the year after.

Appendix Table A1. State student enrollment

Academic Years	Individual(s) that hand-entered data	Original Source(s) of data
1959-60 to 1985-86	Paglayan (2019)	U.S. Department of Education (DOE) and National Center for Education Statistics (NCES) series reports; for more information, see data appendix of Paglayan (2019)
1986-87 to 2016-17	Not applicable	National Public Education Financial Survey (NPEFS); for more information, see https://nces.ed.gov/ccd/stfis.asp

Appendix Table A2. State education revenues

Academic Years	Individual(s) that hand-entered data	Original Source(s) of data	Other notes
1959-60	Paglayan (2019)	U.S. Department of Education (DOE) and National Center for Education Statistics (NCES) series reports; for more information, see data appendix of Paglayan (2019)	
1960-61	missing (interpolated)	Missing data was estimated through linear interpolation using data from the year prior and year after	
1961-62	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1962-63	Candelaria, Shores, & McNeill	U.S. Department of Health, Education, and Welfare, Office of Education. 1963. *Digest of Educational Statistics, 1963*. Washington, DC: U.S. Government Printing Office. Table 31; pg. 42	State revenues are estimates

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Appendix Table A2 - continued from previous page.

Academic Years	Individual(s) that hand-entered data	Original Source(s) of data	Other notes
1963-64	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1964-65	missing (interpolated)	Missing data was estimated through linear interpolation using data from the year prior and year after	
1965-66	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1966-67	Candelaria, Shores, & McNeill	U.S. Department of Health, Education, and Welfare, Office of Education. 1967. *Digest of Education Statistics, 1967*. Washington, DC: U.S. Government Printing Office. Table 68; pg. 54	State revenues are estimates
1967-68	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1968-69	Candelaria, Shores, & McNeill	NCES. 1969. *Digest of Education Statistics, 1969*. Washington, DC: U.S. Government Printing Office. Table 66; pg. 49	State revenues are estimates
1969-70	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1970-71	Candelaria, Shores, & McNeill	NCES. 1972. *Digest of Education Statistics, 1971*. Washington, DC: U.S. Government Printing Office. Table 70; pg. 52	State revenues are estimates
1971-72	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1972-73	Candelaria, Shores, & McNeill	NCES. 1974. *Digest of Education Statistics, 1973*. Washington, DC: U.S. Government Printing Office. Table 69; pg. 58	State revenues are estimates

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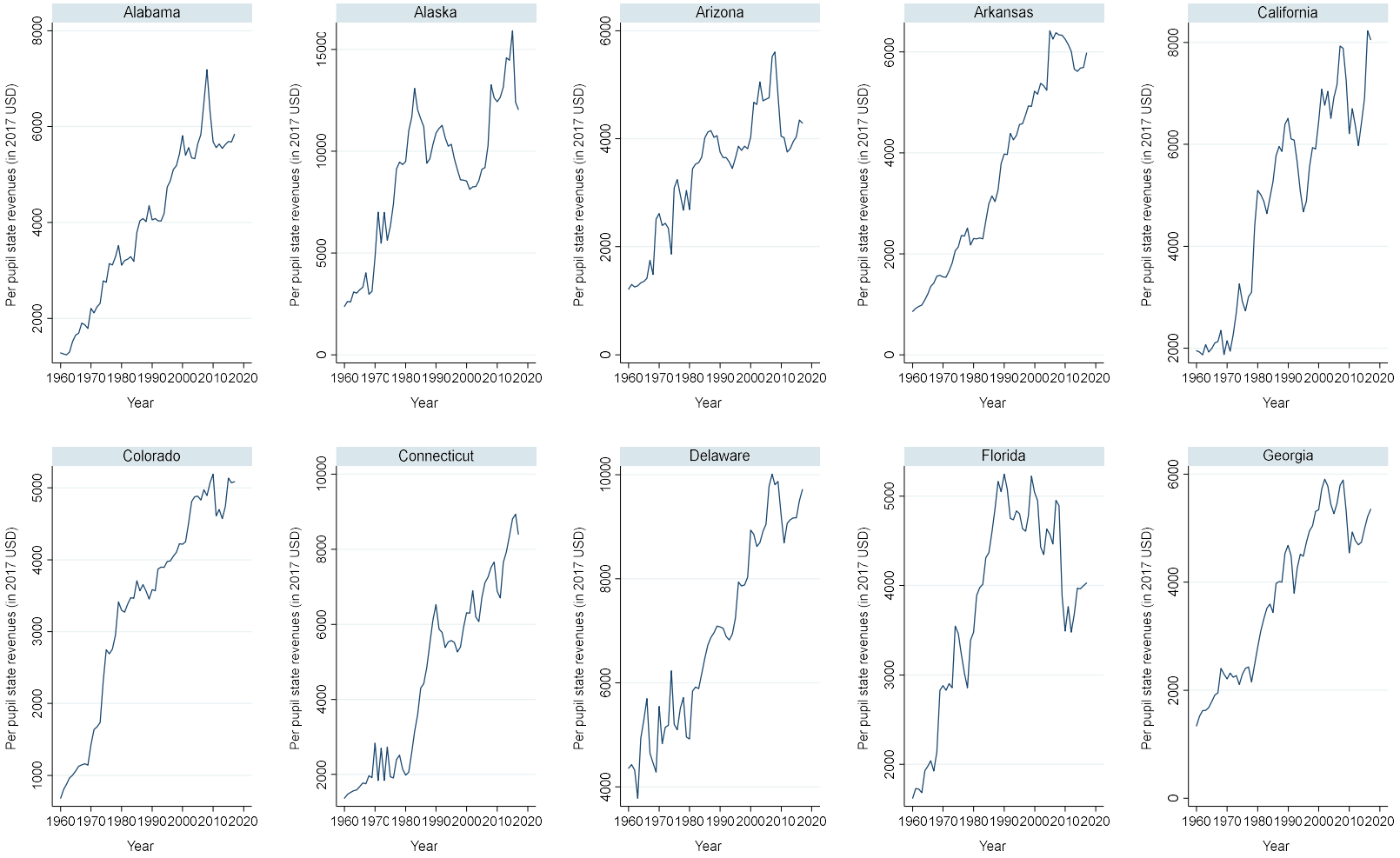
Appendix Table A2 - continued from previous page.

Academic Years	Individual(s) that hand-entered data	Original Source(s) of data	Other notes
1974-75	Candelaria, Shores, & McNeill	NCES. 1998. *State Comparisons of Education Statistics: 1969-70 to 1996-97.* Washington, DC: U.S. Government Printing Office. Table 32; pg. 83	
1975-76 to 1980-81	Paglayan (2019)	DOE and NCES series reports; for more information, see data appendix of Paglayan (2019)	
1981-82	missing (interpolated)	Missing data was estimated through linear interpolation using data from the year prior and year after	
1982-83	Candelaria, Shores, & McNeill	NCES.1986. *Digest of Education Statistics, 1986.* Washington, DC: U.S. Government Printing Office.Table 70; pg. 81	
1983-84	Candelaria, Shores, & McNeill	NCES.1987. *Digest of Education Statistics, 1987.* Washington, DC: U.S. Government Printing Office.Table 95; pg. 109	
1984-85	Candelaria, Shores, & McNeill	NCES. 1988. *Digest of Education Statistics, 1988.* Washington, DC: U.S. Government Printing Office.Table 109; pg. 126	
1985-86	Candelaria, Shores, & McNeill	NCES. 1989. *Digest of Education Statistics, 1989.* Washington, DC: U.S. Government Printing Office. Table 140; pg. 150	
1986-87 to 2016-17	Not applicable	National Public Education Financial Survey (NPEFS); for more information, see https://nces.ed.gov/ccd/stfis.asp	

Appendix B. Trends Over Time, 1960-2017

Appendix Figure B1. Trends in per pupil state revenues by state, 1960-2017



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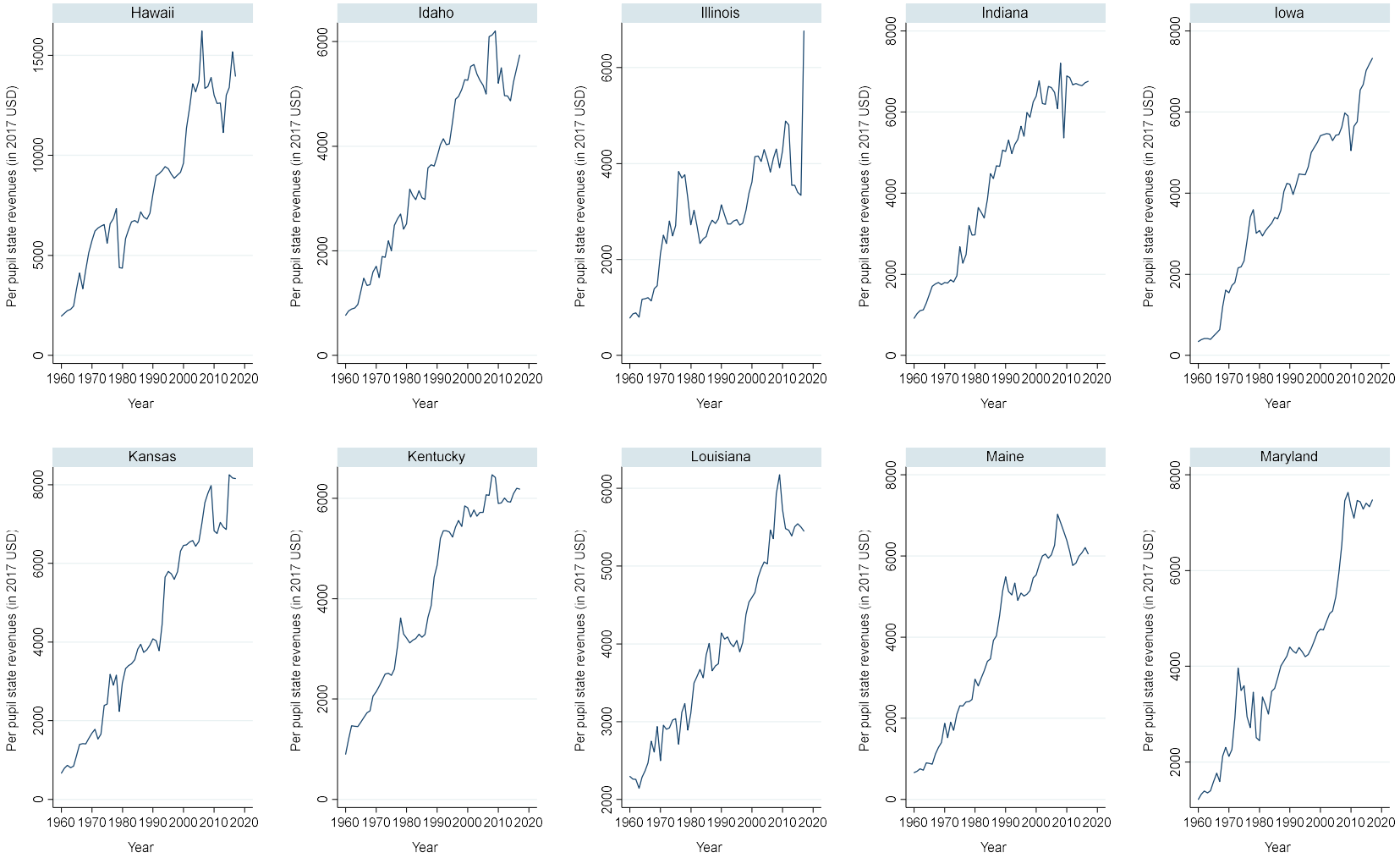
Appendix Figure B1. Trends in per pupil state revenues by state–continued from previous page



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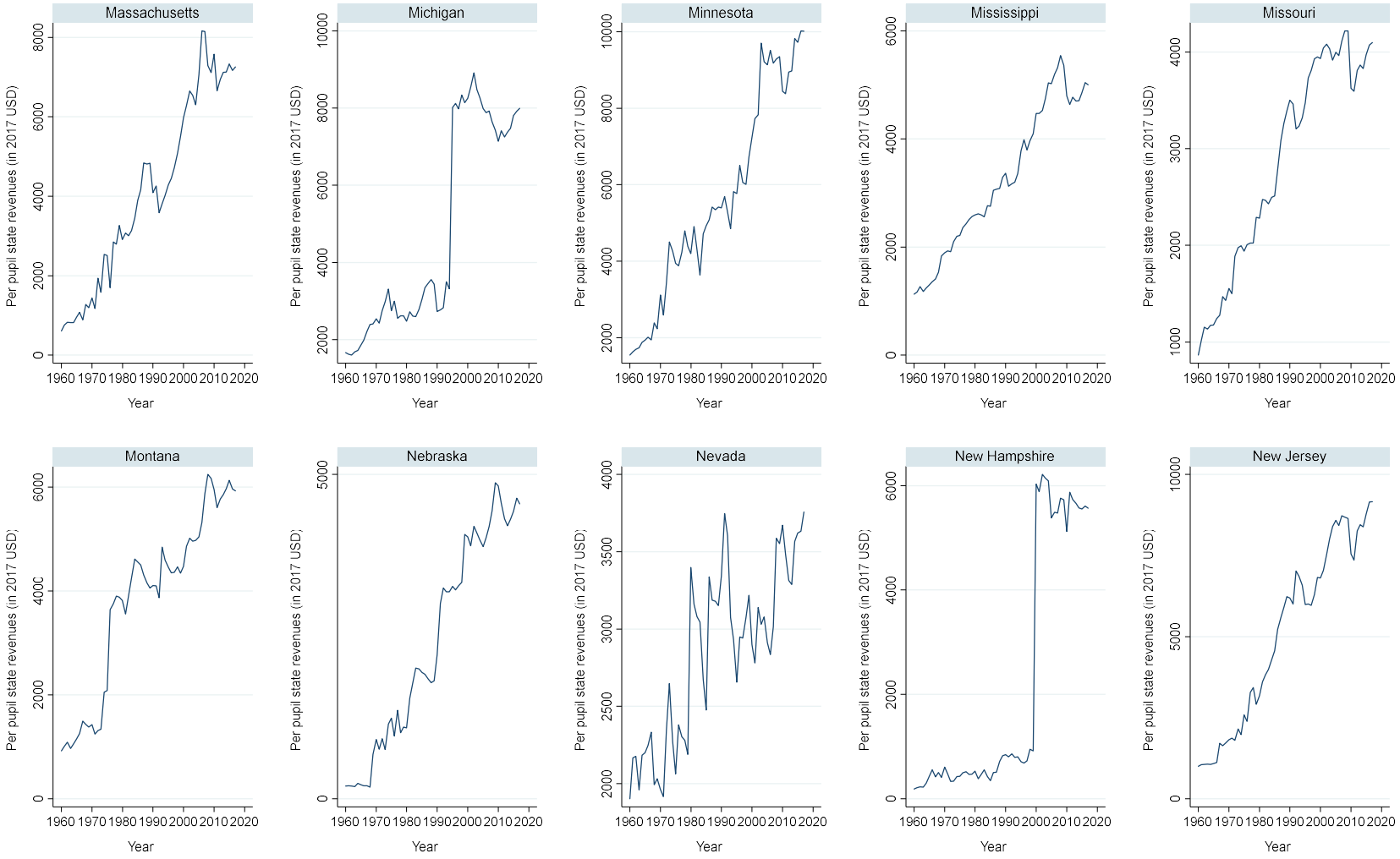
Appendix Figure B1. Trends in per pupil state revenues by state–continued from previous page



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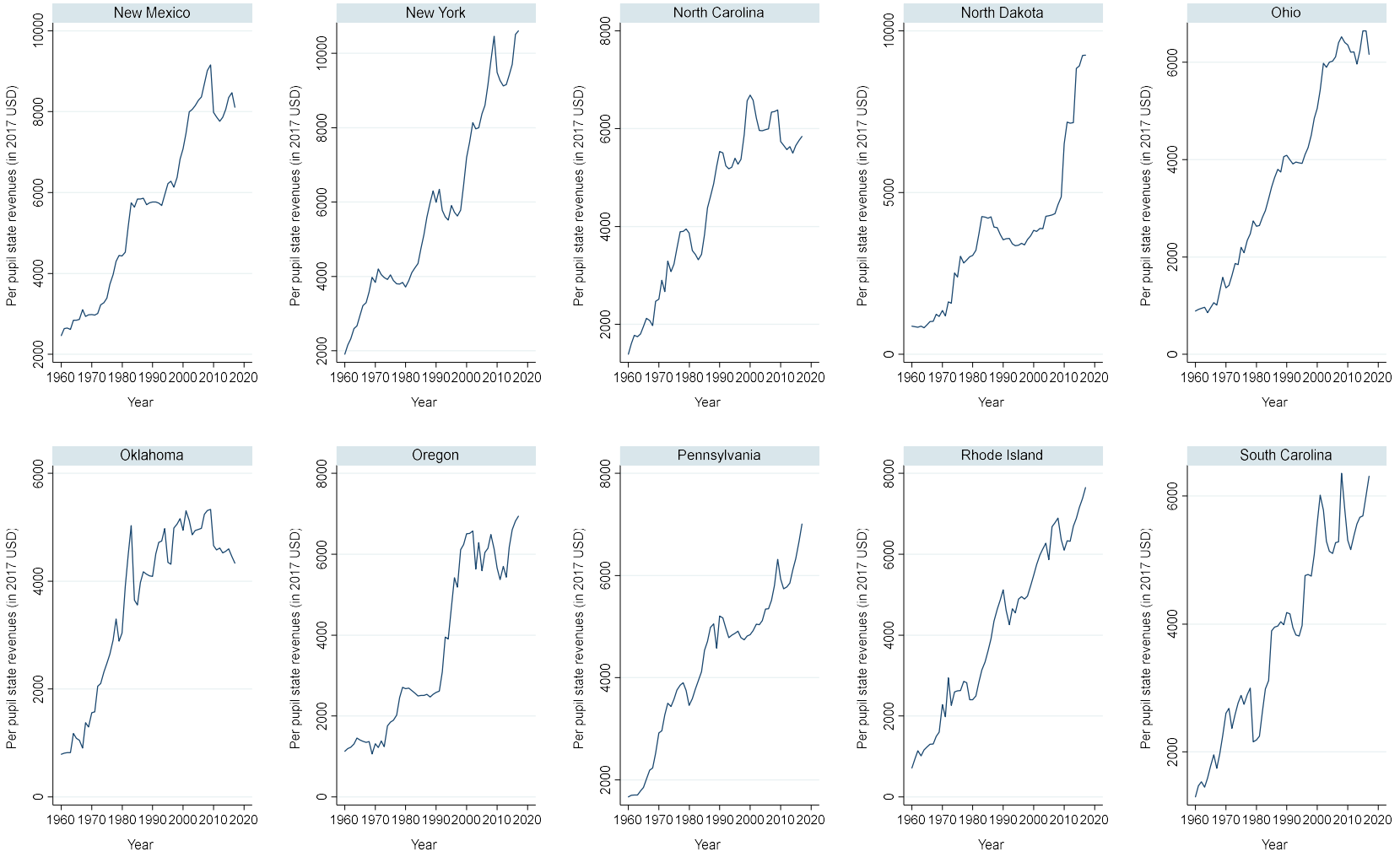
Appendix Figure B1. Trends in per pupil state revenues by state–continued from previous page



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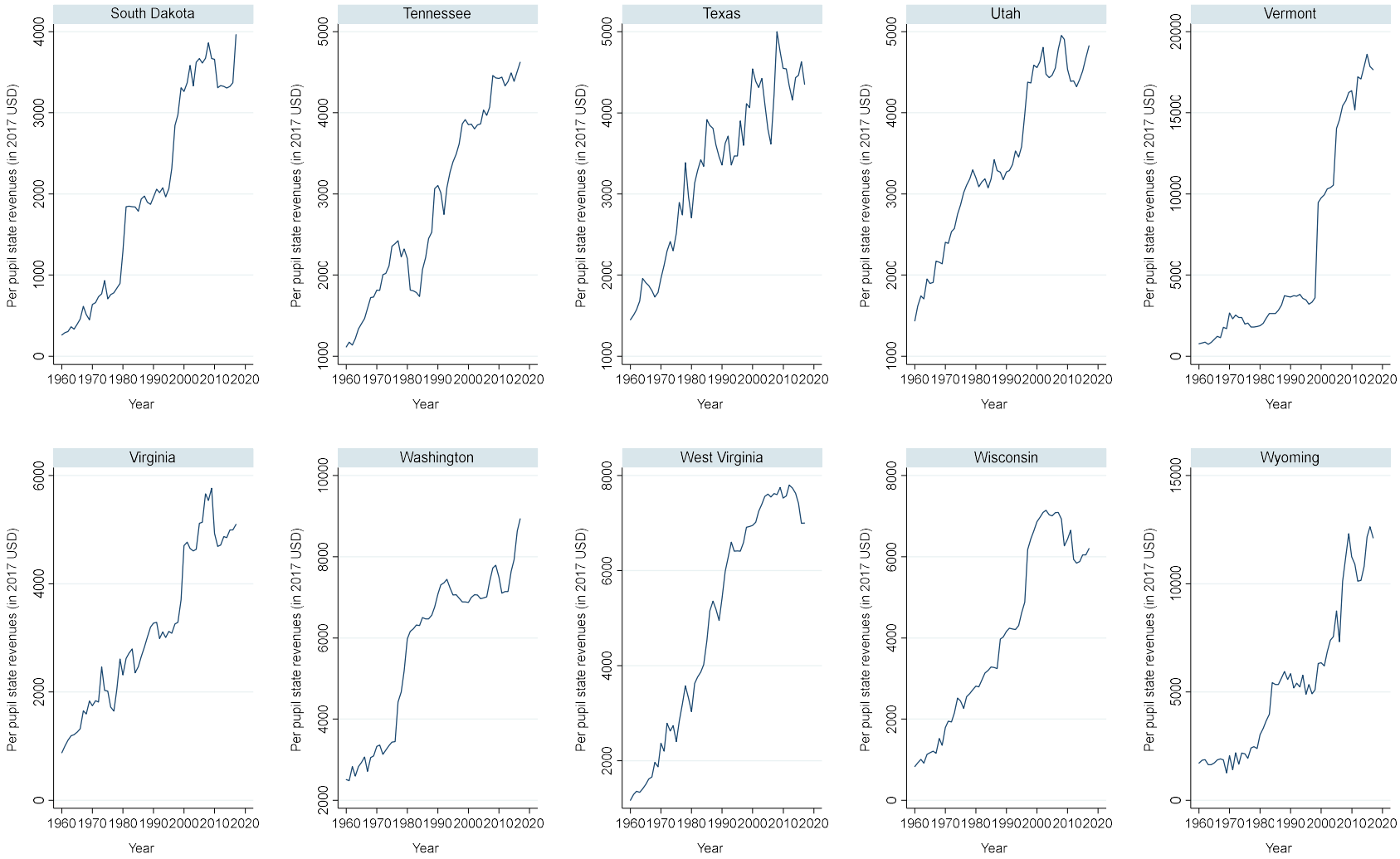
Appendix Figure B1. Trends in per pupil state revenues by state–continued from previous page



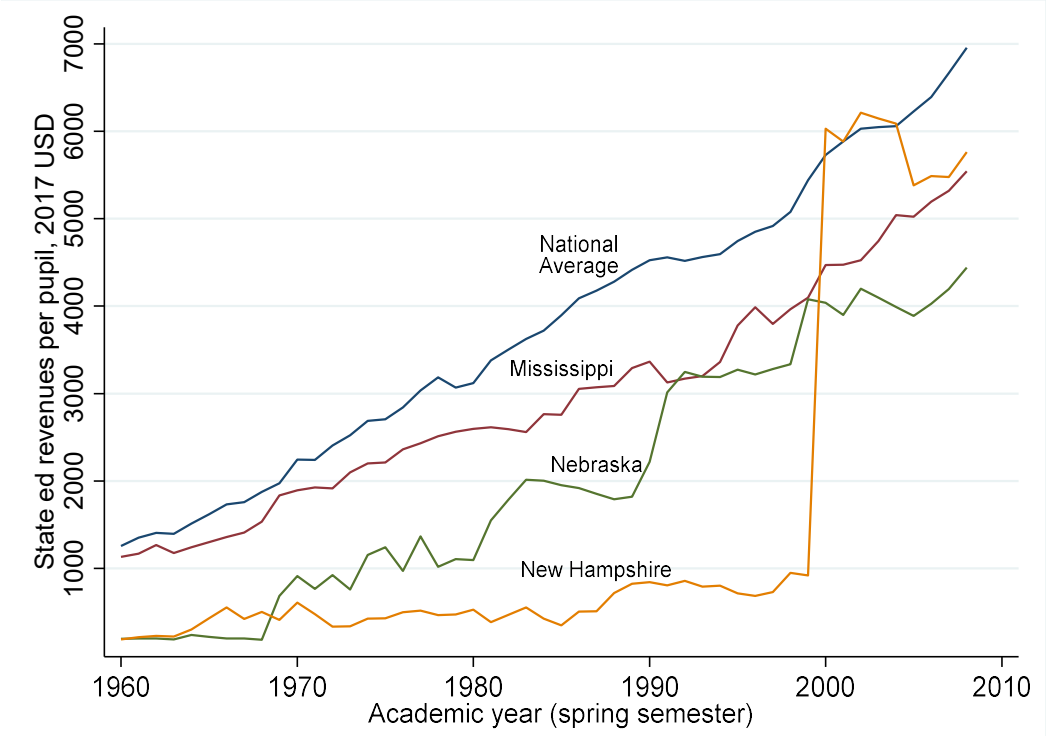
CHAPTER 3

Why is State Elementary-Secondary Education Funding Rising? A Description of the Events Preceding Increases in State Education Revenues during the Adequacy Era

Co-authored with Christopher Candelaria and Kenneth Shores

Over the past sixty years, there has been a long-term, positive trend in state investments in elementary-secondary education (grades pre-kindergarten through grade 12), as evidenced by average state funding per pupil consistently increasing by about $1000 every decade (see Figure 1). When examining state contributions to education over time across states, some states' trends in education revenues generally mirror that of the national average; as shown in Figure 1 below, Mississippi's time series of state funding per pupil is an example of such steady, rather consistent increases in revenues over time.

Figure 1. Average per-pupil state education revenues over time, select states



Notes: Data was compiled from various sources; see the "State Education Funding Data" Methods section of the paper for further details.

However, other states' time series suggest that distinct shifts or "changepoints" in state investments have occurred at specific time points, as manifest by abrupt changes in trend between time *t* and time *t+1* as well as more gradual shifts in trend that occur over multiple time points. New Hampshire's and Nebraska's time series visually provide evidence of *positive* changepoints in state revenues that have contributed to rising state education investments over time (see Figure 1 above).[52] New Hampshire experienced a positive changepoint in the year 2000, when their per pupil state revenues abruptly increased by about $5000 (going from approximately $1000 per pupil in 1999 to $6000 per pupil in 2000). In contrast, Nebraska's positive changepoint in the year 1988 is indicative of more of a trend shift, as evidenced by the trend in per pupil state revenues shifting from declining by $200 between 1983 and 1988 to increasing by approximately $1450 between 1988 and 1992.

A question that emerges from these descriptive trends is what events gave rise to the positive changepoints in state education investments seen in some states' time series? A large literature has linked school finance reforms [SFRs] to changes in state education funding (e.g., Chapter 1 of this dissertation; Lafortune et al., 2018; Liscow, 2018; Murray et al., 1998; Shores et al., 2021). SFRs, as typically defined in the literature, are state-level reforms that result from a court ruling or legislative statute that lead to major redesigns of a state's school funding formula and/or increased state education funding for elementary-secondary education. Since the early 1970's, when SFRs first began to occur, 40 states have been documented as having had one or more court-ordered or legislative SFRs.[53] A myriad of studies have shown that SFRs significantly increase state funding for education on average, especially in low-income school

[52] Changepoints can also reflect negative changes (i.e., decreases) in trend.
[53] Based on court-ordered and legislative SFRs that occurred between 1971 and 2007 (just prior to the Great Recession), as documented in Hoxby (2001), Jackson et al. (2016) and Lafortune et al. (2018).

districts (Liscow, 2018; Lafortune et al., 2018; Shores et al., 2021). Thus, it seems highly probable that SFRs (or more specifically, court and legislative activity related to state education finance systems) are motivating at least some of the positive changepoints that we observe in state education investments.

But what events motivate positive changepoints in state education revenues in states without a documented SFR? For example, Nebraska has no documented history of an SFR,[54] yet there is visible evidence that the state experienced a positive shift in state contributions to education around 1990 (as shown in Figure 1). Shores et al. (2021) found that states without a documented SFR increased state revenues to low-income districts at least as much as more than half of states with documented SFRs, and that average state revenues per pupil followed very similar trajectories over time regardless of whether a state had a documented SFR or not.

One explanation for positive changepoints in states without a documented SFR could be that all court rulings and/or legislative acts which subsequently lead to positive changepoints have not been documented. In other words, the lists of SFRs used in other studies may be incomplete and not include all court and legislative activity which has resulted in increased state education funding. Another explanation could be that other types of events besides court and legislative activity are leading to positive changepoints in state education funding. For example, constitutional amendments passed by popular vote which change how schools are funded (as occurred in Michigan in 1994) or how schools are structured (as occurred in Florida in 2002) might plausibly result in changepoints in state education revenues. Or, holding governmental interventions and tax policies constant, a boom in natural resource extractions (e.g., natural gas,

[54] SFR lists used by Hoxby (2001), Jackson et al. (2016) and Lafortune et al. (2018) do not list Nebraska as having had an SFR.

oil, coal) or energy creation (e.g., power plants or wind energy installations) which leads to increased state revenues could result in increased state education revenues.

A comprehensive description of a) when positive changepoints in state education investments have occurred and b) which specific events motivate these positive changepoints would be useful for both policy makers and researchers. Undertaking reforms to their education finance systems can be a costly endeavor, both in terms of money and time, for states; thus, examples of the ways in which state education funding was successfully increased could serve as a guide to state government officials and policy makers who are currently pursuing or considering reforms to the education finance systems in their state. The empirical literature on school finance generally and state school finance reforms specifically would also benefit from a clearer understanding of the events or policy changes associated with increased state investments in education. A description of the general types of events that lead to shifts in state education funding, such as passing various types of legislative acts, would be useful for establishing a conceptual framework on how state education investments are increased. Further, identifying the specific events that have preceded positive changepoints in state education revenues over the last few decades could in turn lead to a more comprehensive list of states that have experienced SFRs. Accurately identifying which states have and have not experienced an SFR is crucial to obtaining unbiased effect estimates of finance reforms.

In this essay, we use a newly-digitized, annual panel of per pupil state education revenues data spanning fiscal years 1960 to 2008 and a Bayesian time series decomposition algorithm to identify in which states and years positive changepoints in state education revenues have occurred during the adequacy era (i.e., post-1990). We generally define a positive changepoint as a point in a state's time series at which the slope of the trend in per pupil education revenues

increases (i.e., becomes more positive).[55] We then conduct a wide search using multiple types of sources (e.g., websites, journal articles, books, published reports, and longitudinal state revenues data) to identify the key, state-level events that precede or coincide with the years at which positive changepoints in per pupil state education revenues occurred. Based on our understanding of potential events that most likely motivate changepoints (discussed further in the background section of the paper), we specifically focus on documenting legislative activity, court activity, constitutional amendments, and resource shocks that were plausibly related to increases in state education funding.[56] Following the search for events, we descriptively analyze the extent to which these four types of events preceded changepoints. We use these calculations along with illustrative examples of specific events to provide a description of the events that precede positive increases in state education funding.

In the next section, we further describe the types of events that could potentially motivate significant shifts in state education revenues. We then review the data and methods used, followed by the results of our analysis. We conclude with a discussion of our findings and suggest future research.

Background

State investments in elementary-secondary education have been consistently increasing, on average, since the 1960's (see Figure 1). Yet, a conceptual framework or written description

[55] As we discuss in the Methods section, we use a Bayesian algorithm called BEAST [A Bayesian Estimator of Abrupt change, Seasonal change, and Trend] (Zhao et al., 2019) to detect changepoints in the per pupil state education funding time series data. Changepoints identified by the BEAST algorithm that are associated with a second difference value that is greater than zero are considered positive and included in our selected sample. We do not include negative changepoints in our selected sample, nor do we search for events associated with negative changepoints.

[56] We do not view our work as definitively identifying the causes of positive changepoints in state education revenues, as an infinite number of causes can potentially motivate any one effect. Rather, our study attempts to identify key events that are plausibly related to such changepoints.

of the various events or policy changes that lead to distinct shifts or changepoints in state investments in elementary-secondary education is largely absent from the extant school finance literature. Such a framework would be useful in understanding the positive trends in state education funding that we see occurring over the past sixty years in all states and could serve as a guide in more narrow searches into the events associated with specific changes in state education funding in a given state and year.

Given the above, we attempt to broadly conceptualize the types of events that could potentially motivate positive changepoints in state education revenues. Specifically, we speculate that four types of events primarily precede positive changepoints in state education revenues: constitutional amendments, legislative activity, court activity, and resource shocks. We discuss how each of these events can potentially relate to changing state education funding below. We draw upon the SFR literature, as well as the literature on education funding more broadly. However, we also acknowledge that state education funding could increase due to events that have not been stated here, providing further impetus for the comprehensive study of events associated with positive changepoints in state education investments.

Constitutional Amendments

State constitutions generally set the foundation or ground rules for public elementary-secondary education in each state. Every state constitution includes an education clause that defines the rights of citizens (and children), the duties of the state, and the characteristics of the education system that will be provided (Dallman & Nath, 2020; Parker, 2016). However, there is variation across states in the specific wording used in constitutions to describe public school systems, which has consequences for how schools are funded in each state. Some state constitutions only require the establishment of a “free” or “common system” of education, while

others include more prescriptive wording in their education provisions, such as "uniform", "efficient", "equal rights", and "high-quality education" (Dallman & Nath, 2020).

The language used in education clauses can be changed via constitutional amendments, which in turn, can alter how public elementary-secondary education is provided by states. Amendments can be proposed by the legislature or, in some states, directly by citizens.[57] Between 1990 and 2018, a total of 312 amendments related to the education clause were proposed across the country. 153 of those 312 amendments (49%) sought to add or amend language regarding education funding and expenditures. 62% of the 312 education-related amendments were passed, while 64% of the 153 amendments specifically related to education funding passed (Dallman & Nath, 2020).

A constitutional amendment that either a) changes how the education system is funded, or b) broadly alters how the education system itself is run, could lead to positive changepoints in state education funding. Well-known examples of increased state education spending per student following state constitutional amendments can be found in Michigan and Florida. In March 1994, Michigan's state legislature referred and state citizens approved of a constitutional amendment, Proposal A, which amended the tax system (specified in Title IX of the Michigan Constitution) that raised revenues for schools. Specifically, Proposal A increased sales and use taxes, as well as a mix of other state taxes (e.g., real estate taxes, taxes on alcohol and cigarettes). Because all revenues generated from the Proposal A tax increases were earmarked for the state School Aid Fund, state revenues dedicated to education increased drastically over the next few

[57] The legislature-initiated constitutional amendment process begins with the legislature passing an act that proposes changes to the state constitution. Citizens then vote on the proposed amendment. In contrast, a citizen-initiated amendment process begins with citizens proposing an amendment and collecting signatures via petition to put the proposal on the ballot. If enough signatures are obtained, citizens then vote on the proposed amendment. Legislature-initiated amendments are allowed in all states, whereas only 18 states currently allow citizen-initiated amendments (Dallman & Nath, 2020).

years in Michigan (Cullen & Loeb, 2004). Between 1994 and 1995 alone, per pupil state education revenues jumped from an average of $3300 to $8000 (authors' calculations). Similarly, in 2002, state citizens approved an amendment to the Florida Constitution that set class size limits in public elementary-secondary schools. In turn, the Florida Legislature was legally obligated (under Article IX, section 1 of the Florida Constitution) to provide funds to reduce the average number of students in each classroom. The total cost to implement the class size reduction amendment was estimated to be about $20 billion over the first eight years, with continuing operating costs of about $4 billion per year in subsequent years (Chingos, 2012).

Legislative Activity

Each state has laws and statutes which build off the education clause of their state constitution and provide further parameters regarding how public elementary-secondary education is provided and funded. For example, all states have laws establishing school funding formulas, which determine the total amount of funds needed to educate each student and the state's share of those costs (Chingos & Blagg, 2017; Skinner, 2019). States also have laws establishing which revenue sources fund education (typical state sources include income taxes, retail sales taxes, "excise" taxes such as those on alcohol and tobacco products, and revenues from state lotteries) (Skinner, 2019).

The legislature is the branch of the state government that is authorized and responsible for passing laws and statutes, as well as approving state budgets and appropriating state funding for education. In the 2021 legislative session alone, state legislatures across the country enacted (i.e., passed) approximately 600 bills related to elementary-secondary education.[58] As such, we

[58] Author's calculation using the National Conference of State Legislatures Education Bill Tracking Database. The database can be accessed here: https://www.ncsl.org/research/education/education-bill-tracking-database.aspx.

suspect that education-related legislative activity likely frequently precedes positive changepoints in state education funding. Examples of specific legislative activity that influences state education funding include: passing an act that alters the school funding formula for determining state aid for education; passing legislation which establishes a state lottery and dedicates lottery proceeds to education; or, passing a bill which appropriates increased state funding for school construction and capital improvements. Quasi-experimental studies have also confirmed that—even in the absence of a court order—legislative acts which make significant changes to a state's school finance system result in dramatic increases in per pupil state education funding on average (Lafortune et al., 2018; Shores et al., 2021).

Court Activity

The judicial or court system has historically played a key role in motivating increased state investment in education. While state judicial systems are *not* responsible for appropriating education funding (as that is the responsibility of state legislative systems), state judicial systems *are* responsible for determining whether states legislatures are fulfilling their constitutional obligations to maintain and provide systems of public education (Obhof, 2019). Since the early 1970's, 45 of the 50 state court systems have considered one or more court cases in which citizens have argued that the state has failed to provide equitable or adequate levels of funding necessary to comply with the educational provisions of their state constitutions.[59] Well-known court cases include *Serrano v. Priest* (1971) in California and *Rose v. Coucil for Better Education* (1989) in Kentucky.

[59] See http://www.schoolfunding.info/ for a map of the 45 states with school-funding court decisions as of January 2022, as well as for further details on education-finance litigation in each state.

In turn, court systems in 26 states have ruled that students have a legally enforceable right to "equity" or "adequacy" in school funding under their state's constitutions.[60] As a result, legislatures in these states have been required via court order to reform their school finance systems which often entail increased state education spending. Examples of legislative acts focused on school finance reform that followed a court order include Kentucky's 1990 Kentucky Education Reform Act (preceded by *Rose v. Coucil for Better Education, 1989*), Massachussetts' 1993 Massachusetts Education Reform Act (preceded by *McDuffy v. Secretary of State of the Excecutive Office of Education, 1993*), and Vermont's 1997 Equal Educational Opportunity Act (preceded by *Brigham v. State, 1997*).

In addition, it is interesting to note that some legislation has been passed in order to *prevent* a court ruling. This happened in the case of Nebraska's Tax Equity and Educational Opportunities Support Act [TEEOSA]. The act was passed in April 1990 by the state legislature, shortly after a court case challenging Nebraska's state finance system was filed in January 1990. Based on these examples, it seems highly probable that court activity (including court rulings and court filings) often prompts the legislative activity that motivates positive changepoints in state education investments.

Resource Shocks

The events described above (constitutional amendments, legislative activity, and court activity) can all be broadly defined as "government interventions" that potentially lead to positive changepoints in state education funding. However, increases in the overall size of the state budget, while holding government intervention constant, could also possibly result in

[60] See http://www.schoolfunding.info/ for a map of the 26 states that have ruled that students have a legally enforceable right to "equity" or "adequacy" in school funding as of January 2022.

changepoints in state education funding. One way that state budgets could increase without passing laws that increase revenue collections could be through the phenomena of "resource shocks". Specifically, increases or shocks in natural resource and renewable energy (ex. natural gas, oil, coal, power plants, wind energy installations) production or prices can generate additional revenues for states via increased state severance taxes, property taxes, leases of state land, and corporate income taxes (Newell & Raimi, 2015). States that derive a significant amount of their general and/or education revenue from resource production could thus experience large increases in education funding as a result of resource shocks.[61] While no studies that we are aware of have examined the effects of resource shocks on state education spending, Marchand and Weber (2020) found that increased local tax revenues driven by oil and gas booms in Texas led to increased per pupil education spending at the local level.

Methods

State Education Funding Data

Identification of changepoints in state education funding, on which our search for policy changes and events relies, requires a time series of state funding data. We specifically leverage an annual, state-level panel of state education revenues and student enrollment data from 1959-1960 to 2007-08.[62] For years 1986-87 to 2007-08, we obtain revenues and enrollment data from the National Public Education Financial Survey [NPEFS], which is distributed by the National Center for Education Statistics [NCES]. Revenues and enrollment data from 1959-60 to 1985-86

[61] In 2013, the top 16 oil- and gas-producing states collected approximately $28 billion in revenues from oil and gas production (Newell & Raimi, 2018). Texas in particular has been the epicenter of the U.S. oil and gas drilling boom throughout the twenty-first century (Marchand & Weber, 2020). Other forms of energy creation are also becoming more prevalent across states, including wind energy. In 1995, wind energy production was primarily concentrated in two states (California and Texas); by 2016, wind energy production had expanded to 38 states (Brunner et al., 2021)
[62] We only use data up to the 2007-08 school year in order to limit our detection of positive changepoints to years before the fiscal shock of the Great Recession occurred.

were obtained from U.S. Department of Education [DOE] and NCES series reports, including *Digest of Education Statistics* and *Statistics of State School Systems*. These reports are the predecessors of NCES' Common Core of Data [CCD]. Data from these reports were hand-entered by either Paglayan (2019) or Candelaria, Shores, and McNeill because they had not been previously digitized. Further details on the compilation of and sources for the annual panel dataset can be found in Appendix A of Chapter 2 of this dissertation.

State education revenues are defined as revenues given to districts by the state and include unrestricted grants-in-aid, restricted grants-in-aid, revenue in lieu of taxes, and payments for, or on behalf of, districts.[63] State student enrollment represents the total count of students enrolled in public elementary or secondary schools (in grades pre-kindergarten through grade 12) in the Fall (typically October 1) of the academic year. State education revenues are transformed into 2017 USD using the *cpiget* Stata command (Shores & Candelaria, 2019)[64] and then divided by state student enrollment to provide a per-pupil estimate.

Identification of Changepoints

To detect changepoints in the per pupil state education funding time series data, we use a Bayesian decomposition algorithm called BEAST [A Bayesian Estimator of Abrupt change, Seasonal change, and Trend], developed by Zhao et al. (2019). In what follows, we discuss the BEAST algorithm in further detail and why we chose it over other time series decomposition methods. Then we discuss the application of BEAST specifically to our state education funding time series data to identify positive changepoints.

[63] Federal revenue distributed by state governments is not included in our measure of state education revenues.
[64] This command transforms nominal into real dollars using an annual average of monthly Consumer Price Index data over the academic year (i.e. July 1 to June 30).

Time Series Decomposition & BEAST

In general, decomposition methods decompose a time series into three model components: time trends, which reflect the long-term progression of the series; intercept or trend changes at specific points in the time series, referred to hereafter as "changepoints"; and random error. However, a large or infinite number of model decompositions based on various algorithms can be applied to any one time series (see Aminikhanghahi & Cook (2017) or Burg & Williams (2020) for an overview of decomposition methods). For example, the trend component alone can be parameterized and approximated by a multitude of linear, piecewise-linear, or polynomial specifications. Decomposition methods that are based on frequentist statistics typically try to choose one so-called "single-best" model from among the infinite number of model decompositions using certain selection criteria, such as Akaike's information criterion (AIC) or the Bayesian information criterion (BIC). Nevertheless, various "best" models can be chosen for the same time series depending on the selection criteria used.

To overcome these issues, we use a Bayesian algorithm for time series decomposition called BEAST [A Bayesian Estimator of Abrupt change, Seasonal change, and Trend] (Zhao et al., 2019). Unlike frequentist methods that choose only a single best model, BEAST is able to synthesize across a large proportion of the almost infinite number of possible model decompositions using a weighted average model. BEAST specifically decomposes a given time series into trend, changepoint, and error components via numerous "competing" models.[65] All these models potentially provide useful information about the "true" model; as such, synthesizing these models is often better than choosing a single best model. BEAST quantifies the usefulness of models by assigning each model decomposition a probability of being the

[65] BEAST can also identify a seasonal trend component if desired; however, our data are at the annual level, so we do not use this feature.

"true" model. Then, the BEAST algorithm uses these probabilities as weights to combine all models into one weighted average model. Applying the weighted average model to a given time series, BEAST is able to estimate the fitted trend and changepoint components, as well as estimate confidence intervals associated with the fitted trends and changepoints. Averaging across many models helps BEAST to capture model uncertainty, reduce concerns regarding model misspecification, and improve the modeling of complex data (Zhao et al., 2019). We decompose each of the fifty per pupil state revenue time series, that span the years 1960 to 2008, individually using the BEAST algorithm.[66,67]

Identifying Positive Changepoints

The BEAST algorithm identifies changepoints at specific points in the time series. The algorithm is capable of identifying intercept changes (i.e., abrupt changes between time *t* and time *t+1)* or trend changes (i.e., more gradual changes that occur over multiple time points), as well as both positive or negative trend deviations (i.e., increases or decreases in trend), in the time series as changepoints. However, in this essay, we are specifically concerned with identifying policy changes and events associated with *positive* deviations in state elementary-secondary education investments. Thus, we limit our selected sample of changepoints and our search for events to the years in which positive changepoints occurred (i.e., we do include negative changepoints in our selected sample, nor do we search for events associated with negative changepoints).

[66] The unique weighted average model decomposition applied to each time series was synthesized across 5 million "competing" models.

[67] Note that in Chapter 2 of this dissertation, the BEAST algorithm was used to decompose per pupil state revenues time series data from 1960 to 2017 (i.e., the full panel). While the decompositions conducted in Chapter 2 and Chapter 3 thus use data with different time spans, the decomposition results are fairly consistent. See footnote 71 and Appendix Figure A1 in this chapter for additional details.

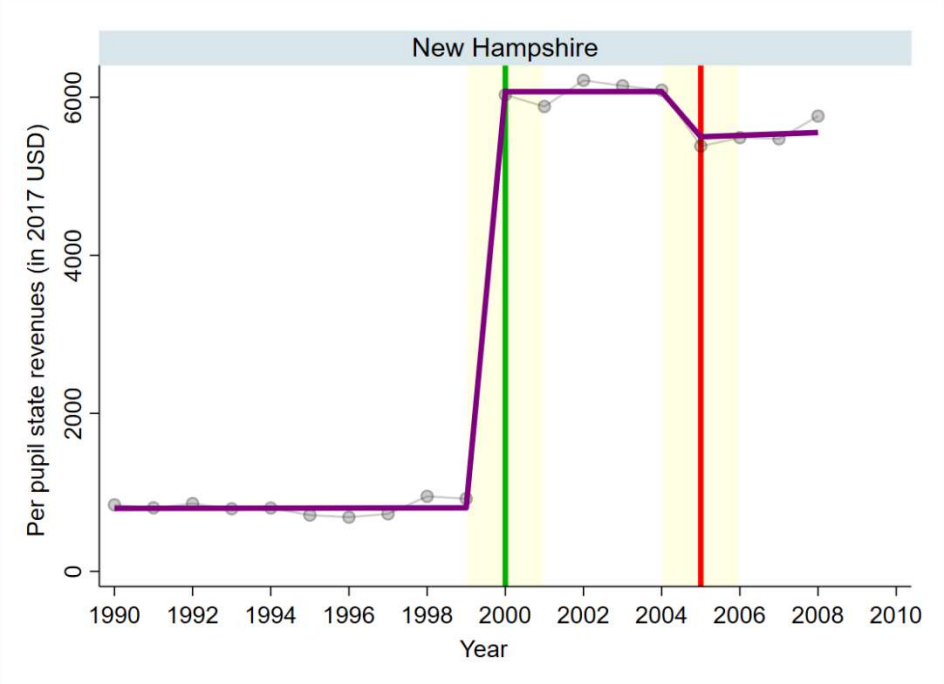
The BEAST algorithm does *not* provide information on whether identified changepoints are reflective of positive or negative changes in trend. As such, for the purposes of this paper, we specifically define a positive changepoint as an identified changepoint that coincides with a positive deviation in the trend line fitted by BEAST. In technical terms, we are interested in identified changepoints at year *t* that are associated with a positive "second difference", meaning the rate of change or slope of the fitted trend line between year *t* and year *t-1* is greater than (i.e., more positive) than the rate of change of the fitted trend line between year *t-1* and year *t-2*. We calculate the second difference associated with a changepoint in the time series of state *s* in year *t* as follows,

$$Second\ difference_{st} = \left(trend_{st} - \ trend_{s(t-1)}\right) - \left(trend_{s(t-1)} - \ trend_{s(t-2)}\right),$$

where *trend* represents the fitted trend value estimated by BEAST. Changepoints identified by the BEAST algorithm that are associated with a second difference value that is greater than zero are considered positive and included in our selected sample.

A visual depiction of positive and negative changepoints and when they occur is shown below in Figure 2 based on New Hampshire's time series of per pupil state revenues. The grey dotted line indicates per pupil state education revenues and the purple line indicates the fitted trend line estimated by BEAST. Green and red vertical lines represent the years in which positive and negative changepoints occur, respectively, and yellow background shading indicates confidence intervals associated with changepoints. The changepoint at FY 2000 is considered positive, as the slope of the fitted trend line between FY 1999 and 2000 is greater in magnitude (i.e., more positive) than the slope of the fitted trend line between FY 1998 and 1999. Thus, the changepoint coincides with a positive trend deviation and is colored green (and is included in our selected sample of positive changepoints). In contrast, the changepoint at FY 2005 coincides

Figure 2. Positive and negative changepoints, New Hampshire



with a negative trend deviation, as the slope of the fitted trend line between FY 2005 and 2004 is smaller in magnitude (less positive) than the slope of the fitted trend line between FY 2004 and 2003. As such, the changepoint at FY 2005 is considered to be negative and colored red (and is not included in our selected sample).

Search for Events

We conduct a wide search that references multiple types of sources to identify state-level events that precede or coincide with the years at which positive changepoints in per pupil state education revenues occurred during the adequacy era (i.e., 1991-2008). The purpose of our search was *not* to provide an exhaustive accounting or timeline of all activities leading up to a changepoint (as might be done, for example, in a case study); rather, our goal was to identify key events that motivated increases in state education revenues. Based on our understanding of potential events that most likely motivate changepoints (discussed in the background section of

the paper), we specifically focused on documenting legislative activity, court activity, constitutional amendments, and resource shocks that occurred and were plausibly related to increases in state education funding.

For each changepoint, the search process generally proceeded as follows. First, we reviewed a set list of six websites, books, and journal articles that were known by the authors to provide general state-by-state overviews of state school finance systems, as well as histories of legislative and court activity related to school finance (specifics on these six sources are listed in Table 1 below). We reviewed the state-specific information that each of these six sources provided for all 35 states that experienced a positive changepoint in order to ensure that we obtained a broad understanding of the state school finance contexts in which changepoints occurred. If any of these sources mentioned an event that a) appeared to be associated with increases in state education revenues in the year of the changepoint and b) occurred in the years prior to a changepoint, we then searched for more detailed information regarding this potential event.

If the potential event was a legislative act, court order, or constitutional amendment, we obtained and reviewed the actual text of the act, order, or amendment when possible.[68] When a potential event was related to legislative activity (e.g., a House or Senate Bill, law, or legislative referendum), we specifically looked for evidence linking the event to increased appropriations for state education. For example, if we found that a House Bill which mandated changes to the school funding formula was passed in the year prior to a changepoint, we reviewed the text of the bill for information on whether increased state funds were appropriated as part of the funding

[68] When the text of some court orders and legislative acts could not be obtained online, we reviewed other secondary sources (academic journal articles, news articles, published briefs or reports) to learn as much about the event as possible.

Table 1. Reference sources with state-specific information on school finance systems

Reference	**Type of source**	**General information provided**
SchoolFunding.Info: http://www.schoolfunding.info/	Website	Overview of school-funding court decisions in each state
50 State Survey of School Finance Policies (2009): https://schoolfinancesdav.wordpress.com/	Website	Overview of history of school finance in each state
Public School Finance Programs of the United States and Canada (1998-99): https://nces.ed.gov/edfin/state_financing.asp	Website	Overview of history of school finance in each state
Education Law Center Litigation State Profiles: https://edlawcenter.org/litigation/states/	Website	Overview of school-funding court decisions in each state
Thompson, D. C., Wood, R. C., Neuenswander, S. C., Heim, J. M., & Watson, R. D. (Eds.). (2019). *Funding public schools in the United States and Indian country*. IAP.	Book	Overview of history of school finance in each state
Shores, K., Candelaria, C., & Kabourek, S. E. (2021). Spending more on the poor? A comprehensive summary of state-specific responses to school finance reforms from 1990–2014. *Education Finance and Policy*, (in press).	Journal article	List of legislative and court-ordered SFRs that occurred between 1989-2011

formula change (because changes to funding formulas, though impactful for how funds are distributed, don't always entail increases in state aid). When there was the potential that a changepoint may have been caused by a resource shock that induced increased state revenues, we quantitatively examined longitudinal state revenues data available from the US Census Bureau's Annual Survey of State Government Finances. We also reviewed any secondary sources (academic journal articles, news articles, published briefs or reports) we found with relevant information about events.

In some cases, our initial review of the six sources with state-specific information on school finance systems (listed in Table 1) did not provide any clues on potential events that could

be motivating a positive changepoint. When this occurred, we conducted a general internet search using an internet search engine (i.e., Google) and the following search string: *[State] AND [Year of changepoint] AND ("state education funding" OR "school finance system" OR "school funding formula)*.[69] If any of the sources found using this general search process mentioned an event that appeared to be related to a given changepoint, we then searched for more detailed information regarding this event using the tactics described in previous paragraphs (i.e., finding and reviewing the actual text of the act, order, or amendment; searching for and reviewing other secondary sources with relevant information).

Information obtained in the search process was recorded and organized in Excel spreadsheets. Specifically, for a given event that was determined to be associated with a changepoint, the following information was recorded: the historical date the event occurred; the type of event (i.e., court order, legislative act, constitutional amendment, resource shock, other event); a brief synopsis of the event, with details on how the event was associated with significant increases in education spending; source(s) where event information was obtained (i.e., specific website or journal article); and any other notes.

Following the search for events, we descriptively analyzed the extent to which different types of events (legislative activity, court activity, constitutional amendments, and resource shocks) preceded changepoints. We use these calculations along with illustrative examples of specific events to provide a description of the policy changes and events that precede positive increases in state elementary-secondary education investments during the adequacy era.

Results

[69] If unsuccessful, we also tried inputting years prior to the changepoint in the search string.

Table 2. States with and years of positive changepoints, 1991-2008

State	Year(s) of positive changepoint(s)
Alabama	---
Alaska	2006
Arizona	---
Arkansas	2005
California	---
Colorado	2003
Connecticut	1999
Delaware	---
Florida	1999
Georgia	---
Hawaii	---
Idaho	---
Illinois	2000
Indiana	---
Iowa	---
Kansas	1994
Kentucky	1991
Louisiana	---
Maine	1999, 2007
Maryland	2005
Massachusetts	---
Michigan	1995, 2001
Minnesota	1993, 2003
Mississippi	---
Missouri	1996
Montana	1993, 2001, 2006
Nebraska	1991, 1999
Nevada	1991
New Hampshire	2000
New Jersey	---
New Mexico	1994
New York	1999
North Carolina	1998
North Dakota	1995
Ohio	1996, 2002
Oklahoma	1997
Oregon	1992
Pennsylvania	2000
Rhode Island	---
South Carolina	1996
South Dakota	1997
Tennessee	1992
Texas	1998
Utah	1996
Vermont	1999, 2005
Virginia	2000
Washington	2007
West Virginia	1991
Wisconsin	1997
Wyoming	---

Positive Changepoints During the Adequacy Era

Table 2 above lists the states identified as having positive changepoints in per pupil state education revenues during the adequacy era (i.e., 1991-2008), as well as the years in which the

positive changepoints occurred.[70] In total, 43 positive changepoints were identified across 35 states' time series. Of those 35 states, 28 (80%) experienced 1 positive changepoint, 6 (17%) experienced 2 positive changepoints, and 1 (3%) experienced 3 positive changepoints. Appendix A contains figures, similar to Figure 2 above, that visually depict the occurrence of changepoints in each state's time series during the adequacy era.[71]

Events Preceding Positive Changepoints

Following the identification of positive changepoints, we conducted a search to identify state-level events that preceded or coincided with the years at which positive changepoints in per pupil state education revenues occurred during the adequacy era. Table 3 below lists, by state and changepoint, the name of the event found to be associated with a given changepoint, as well as the date of the event and type of event (i.e., legislative activity, court activity, constitutional amendment, or resource shock). In total, 68 events were found to be associated with 39 of the 43 (91%) positive changepoints. Events associated with 4 changepoints were unable to be determined.[72] See Appendix Table B1 for a brief synopsis of each event, including details on how the event was associated with significant increases in education spending. For the duration

[70] As a reminder, positive changepoints are defined as identified changepoints that are associated with a second difference value that is greater than zero.

[71] Appendix Figure A1 is similar in design to Figure 5 displayed in Chapter 2 of this dissertation. While both of these figures display the weighted average model decompositions of each state's per pupil state revenues time series, it is important to note that such decompositions were computed using slightly different data between the two figures. Specifically, the decompositions displayed in Appendix Figure A1 of this chapter used per pupil state revenues times series data from 1960 to 2008 (i.e., the pre-recession panel), with the decomposition results from 1990 to 2008 being shown in the figure. In contrast, the decompositions displayed in Figure 5 of Chapter 2 used time series data from 1960 to 2017 (i.e., the full panel). While the decompositions displayed in these two figures were based on time series data with different time spans, the results were fairly consistent. For example, 158 changepoints were identified in the time series decompositions using the pre-recession panel. Of those 158 changepoints, 131 (83%) were also identified in the exact same or similar (i.e., within the confidence interval associated with the changepoint) year in the time series decompositions using the full panel.

[72] The 4 changepoints that we were unable to identify preceding events for occurred in the following states and years: Maine, 1999; Oklahoma, 1997; Pennsylvania, 2000; and Utah, 1996.

Table 3. Events preceding positive changepoints

Changepoint Information		Event Information			
State	**Year of changepoint**	**Event #**	**Event(s) motivating changepoint**	**Date of event**	**Type of Event**
Alaska	2006	1	Oil boom		Resource Shock
Arkansas	2005	1	Act 107 (Second Extraordinary Session, 2003)	2/2/2004	Legislative Act
Colorado	2003	1	Giardino v. Colorado Board of Education, 2000	5/2000	Court Activity
		2	Senate Bill 181	5/9/2000	Legislative Act
		3	Amendment 23 [Colorado Funding for Public Schools Initiative]	11/7/2000	Constitutional Amendment
Connecticut	1999	1	Sheff v. O'Neill, 1996	7/9/1996	Court Activity
		2	Public Act 97-290 [An Act Enhancing Educational Choices and Opportunities]	6/26/1997	Legislative Act
Florida	1999	1	House Bill 17-A [Public School Capital Outlay Program Act]	11/24/1997	Legislative Act
Illinois	2000	1	House Bill 452	12/4/1997	Legislative Act
Kansas	1994	1	Mock v. State (pre-trial opinion)	10/14/1991	Court Activity
		2	The School District Finance & Quality Performance Act [SDFQPA], 1992	5/20/1992	Legislative Act
Kentucky	1991	1	Rose v. The Council for Better Education, Inc., 1989	9/28/1989	Court Activity
		2	House Bill 940 [Kentucky Education Reform Act]	3/24/1990	Legislative Act
Maine	*1999*		*Could not determine*		
Maine	2007	1	Legislative Document 1 [LD l: An Act to Increase the State Share of Education Costs, Reduce Property Taxes and Reduce Government Spending at All Levels]	1/2005	Legislative Act
Maryland	2005	1	Bradford v. Maryland State Board of Education, 1996	10/18/1996	Court Activity
		2	Senate Bill 856 [Bridge to Excellence in Public Schools Act]	5/6/2002	Legislative Act
Michigan	1995	1	Public Act 145	7/20/1993	Legislative Act
		2	Michigan Tax Amendment [Proposal A], 1994	3/15/1994	Constitutional Amendment
Michigan	2001	1	Durant v. State II, 1999	1999	Court Activity
		2	Public Act 297	7/26/2000	Legislative Act
Minnesota	1993	1	1991 Legislation		Legislative Act
Minnesota	2003	1	2001 Legislation		Legislative Act
Missouri	1996	1	Committee for Educational Equality v. State, 1993	1/1/1993	Court Activity
		2	Senate Bill 380 [Outstanding Schools Act]	8/1/1993	Legislative Act
Montana	1993	1	Chapters 13, 14, and 17, Special Laws of January 1992.	Jan 1992	Legislative Act
Montana	2001	1	Senate Bill 100	March 1999	Legislative Act
Montana	2006	1	Columbia Falls Public Schools v. State, 2005	3/22/2005	Court Activity
		2	2005 Legislation	2005	Legislative Act

Continued on next page.

Table 3. Events preceding positive changepoints–continued from previous page

Changepoint Information		Event Information			
State	**Year of changepoint**	**Event #**	**Event(s) motivating changepoint**	**Date of event**	**Type of Event**
Nebraska	1991	1	Legislative Bill 940	1988 (calendar year)	Legislative Act
		2	Filing of Gould v. Orr	Jan 1990	Court Activity
		3	Legislative Bill 1059 [Tax Equity and Educational Opportunities Support Act (TEEOSA)]	4/9/1990	Legislative Act
Nebraska	1999	1	Legislative Bill 806; Legislative Bill 806A (companion appropriations bill)	5/28/1997	Legislative Act
Nevada	1991	1	Assembly Bill 964 [Class-Size Reduction Act]	7/6/1989	Legislative Act
New Hampshire	2000	1	Claremont v. Governor I, 1993	12/30/1993	Court Activity
		2	Claremont v. Governor II, 1997	12/17/1997	Court Activity
		3	House Bill 117	4/29/1999	Legislative Act
New Mexico	1994	1	New Mexico Lottery Act	April 1995	Legislative Act
		2	1996 court ruling	Feb 1996	Court Activity
		3	Senate Bill 100	1997 legislative session	Legislative Act
		4	Zuni School District v. State, 1999	10/14/1999	Court Activity
		5	2001 Legislation	End of 2001	Legislative Act
New York	1999	1	Real Property Tax Law, Section 425 [New York State School Tax Relief (STAR) program]	8/7/1997	Legislative Act
North Carolina	1998	1	North Carolina School Bonds Referendum (Referendum 1), Nov 1996	11/5/1996	Legislative Act
North Dakota	1995	1	Bismarck Public School District No. 1 v. State of North Dakota, 1993 (district court)	2/4/1993	Court Activity
		2	House Bill 1003	5/5/1993	Legislative Act
		3	1995 Legislation (including Senate Bills 2059, 2063, and 2519)	1995 legislative session	Legislative Act
Ohio	1996	1	Filing of DeRolph v. Ohio	Jan 1992	Court Activity
		2	House Bill 671	6/30/1992	Legislative Act
Ohio	2002	1	DeRolph v. State II, 2000	5/11/2000	Court Activity
		2	House Bill 94	5/30/2001	Legislative Act
Oklahoma	*1997*		*Could not determine*		
Oregon	1992	1	Measure 5	11/6/1990	Constitutional Amendment
		2	Coalition for Equitable School Funding v. State, 1991	5/2/1991	Court Activity
		3	Senate Bill 814	1991 legislative session	Legislative Act

Continued on next page.

Table 3. Events preceding positive changepoints–continued from previous page

Changepoint Information		Event Information			
State	**Year of changepoint**	**Event #**	**Event(s) motivating changepoint**	**Date of event**	**Type of Event**
Pennsylvania	*2000*		*Could not determine*		
South Carolina	1996	1	Filing of Abbeville County School District v. State	Nov 1993	Court Activity
		2	Act 145, Part II, Section 119A (General Appropriations Act for 1995-96 year)	06/29/1995	Legislative Act
South Dakota	1997	1	Bezdichek v. State, 1994	Fall 1994	Court Activity
		2	1995 legislation acts	1995 legislative session	Legislative Act
Tennessee	1992	1	Filing of Tennessee Small School Systems v. McWheter I	7/7/1988	Court Activity
		2	Education Improvement Act	3/11/1992	Legislative Act
Texas	1998	1	House Bill 4	6/04/1997	Legislative Act
Utah	*1996*		*Could not determine*		
Vermont	1999	1	Brigham v. State, 1997	2/5/1997	Court Activity
		2	Act 60 [Equal Educational Opportunity Act]	06/27/1997	Legislative Act
Vermont	2005	1	Anderson and Stevens vs. State, 1998	12/22/1998	Court Activity
		2	Act 68	6/18/2003	Legislative Act
Virginia	2000	1	House Bill 1450 budget amendment	4/10/1999	Legislative Act
Washington	2007	1	2005 Legislation	2005	Legislative Act
West Virginia	1991	1	1990 third special session legislation	Aug 1990	Legislative Act
Wisconsin	1997	1	Act 27	7/26/1995	Legislative Act

of the results section, we highlight notable patterns in the types of events that preceded positive increases in state elementary-secondary education investments during the adequacy era.

Legislative Activity Precedes Most Changepoints

We find that legislative activity tends to precede almost all positive changepoints in per pupil state education revenues. Of the 39 changepoints that we were able to identify preceding events for, 38 (97%) were preceded by legislative activity that mandated increased state aid for education either through the passage of a bill by the House or Senate, ratification of a law, or the legislature referring a referendum to be voted on by state citizens (we discuss the one changepoint that was not associated with legislative activity, but rather a resource shock, later on in the results section). Relatedly, 42 of the 68 events (68%) identified as occurring prior to a changepoint are classified as legislative activity.

The prevalence of legislative activity prior to significant increases in state education funding is not surprising, given that state legislatures are the government body tasked with appropriating state funding for education and other state priorities. It is interesting to note, however, that there is variation in what the increased state education funding was specifically appropriated for. In the case of some changepoints, the legislature appropriated more state aid for education in order to adequately fund a new school funding formula that was implemented. For example, Nebraska's 1999 changepoint was preceded by the Nebraska legislature passing Legislative Bill 806 in FY 1997, which altered the funding formula for calculating state aid and increased appropriations for elementary-secondary education by $110 million. Similarly, prior to its changepoint in 1997, Wisconsin's legislature passed Act 27 in FY 1996, which modified the

state school funding formula to a three-tiered equalization plan and mandated that the state provide two-thirds funding of schools (the state was only providing 48% of funding in 1994).[73]

In other cases, increased state appropriations for education via legislative activity were related to local property tax relief. For example, New York's 1999 changepoint was preceded by the 1998 enactment of the School Tax Relief [STAR] program (see Real Property Tax Law, Section 425), which reduced local property tax rates and increased state education funding to reimburse districts for the foregone tax revenue.[74] Legislative activity that increased school construction and capital improvement funding also preceded changepoints in many states, including Florida. Under Florida's 1998 House Bill 17-A [The Public School Capital Outlay Program Act], the legislature agreed to dedicate $2.7 billion in state funds over five years to build and repair schools, which coincided with the state's 1999 changepoint in education revenues.[75] Changepoints were also preceded by legislative activity that increased state education appropriations in order to reduce class sizes (see events related to Nevada's 1991 changepoint in Appendix B) and expand school choice options (see events related to Connecticut's 1999 changepoint in Appendix B).

Court Activity Prompts Legislative Activity

As described above, legislative activity is the primary impetus for increases or changepoints in state education revenues. However, we find that legislative activity related to increased state appropriations for education is often preceded by court activity, suggesting that

[73] See Appendix B for other examples of changepoints preceded by legislative activity related to funding formula changes, such as Illinois' 2001 changepoint, Kansas' 1994 changepoint, Kentucky's 1991 changepoint, Maine's 2007 changepoint, and Maryland's 2005 changepoint.
[74] See Appendix B for other examples of changepoints preceded by legislative activity related to property tax relief, including South Dakota's 1997 changepoint, South Carolina's 1996 changepoint, Oregon's 1991 changepoint, Nebraska's 1991 changepoint, Michigan's 1994 changepoint, and Maine's 2007 changepoint.
[75] See Appendix B for other examples of changepoints preceded by legislative activity related to school construction and capital improvement funding, including North Carolina's 1998 changepoint, Colorado's 2003 changepoint, and Texas' 1998 changepoint.

legislation (and subsequent changepoints) is in many cases "litigation-prompted." Specifically, court activity, followed by a legislative act, occurred prior to 20 of the 39 changepoints (51%). Examples of court activity include the preliminary act of filing a court case, as well as actual court rulings that either uphold or require changes to a state's finance system. We discuss each of these types of court activity below and their prevalence prior to changepoints.

In 12 of the 20 (60%) cases in which court activity + legislative activity preceded a changepoint, state legislatures were "forced" to pass an act that changed their school finance system as a result of a court order. For example, Missouri's 1996 changepoint was preceded by the January 1993 *Committee for Educational Equality v. State* court ruling, in which the court declared Missouri's school funding system unconstitutional and that the state must provide the same educational opportunity to children living in rich and poor districts. Following the court ruling, the state legislature passed Senate Bill 380 in August 1993. The bill enacted a foundation funding formula, as well as increased school funding and improved funding equity by raising taxes. Similarly, New Hampshire's 2000 changepoint occurred following court-ordered legislative activity. In the 1997 *Claremont v. Governor II*, the court ruled that New Hampshire's education finance system was unconstitutional because it enabled inequitable local property tax rates and fostered inadequate educational opportunities. In April of 1999, the New Hampshire state legislature passed House Bill 117, which changed the state school funding formula to a foundation program. The bill also established a statewide property tax and raised a variety of other state taxes in order to provide additional state education funding.[76]

[76] Additional examples of court-ordered legislative activity can be found in Appendix B by referencing changepoints in the following states and years: Colorado 2003, Connecticut 1999, Kentucky 1991, Maryland 2005, Michigan 2001, Montana 2006, New Mexico 1994, North Dakota 1995, Ohio 2002, Vermont 1999.

In the case of five other changepoints, we find evidence that legislative acts were passed following the *filing* of a court case (i.e., prior to a potential court ruling), suggesting that the "threat of court order" is sometimes enough to motivate legislative action. Kansas' 1994 changepoint was preceded by such court-threatened legislative activity. In October 1991, the judge associated with the *Mock v. State* Kansas court case indicated in a pre-trial ruling that if the case went to trial, he would likely declare that Kansas' school funding formula violated the state constitution's requirement that the legislature "make suitable provision for finance of the educational interests of the state." Approximately seven months following the pre-trial ruling, the Kansas legislature implemented a new school funding formula via the School District Finance & Quality Performance Act [SDFQPA]. The SDFQPA established a foundation aid plan, increased state education funding through raising state tax revenues, and reduced local property tax burdens by imposing a uniform local property tax rate.[77]

Lastly, legislative activity related to increases or changepoints in state education revenues sometimes followed "unsuccessful" court activity. Specifically, in the case of four changepoints, legislative activity followed a dismissed court case or a court ruling against the plaintiff. Oregon's 1992 changepoint is illustrative of a situation in which a court case unsuccessfully challenged the state finance system, yet legislative activity followed. In *Coalition for Equitable School Funding v. State* (1991), the plaintiffs argued that Oregon's education finance system violated the state constitution on "equity" grounds; however, the court upheld the school finance system. In that same year, the legislature passed Senate Bill 814, which created a new equalization formula for distributing state aid. In addition, the bill allocated approximately $9.6

[77] Additional examples of court-threatened legislative activity can be found in Appendix B by referencing changepoints in the following states and years: Nebraska 1991, Ohio 1996, South Carolina 1996, and Tennessee 1992.

million in state funds to local districts in 1992 to offset loss of local property taxes. Thus, the legislature still acted to increase state education funding, even though they were not "forced" to do so by the court.[78]

Constitutional Amendments & Changepoints

We do find that, in a handful of situations, amendments to state constitutions precede changepoints in state education revenues. Of the 39 changepoints that we were able to identify preceding events for, 3 (8%) were preceded by a constitutional amendment in addition to legislative activity. Michigan's 1995 changepoint followed the well-known Proposal A constitutional amendment (we provided a brief description of Proposal A previously in the background section of the paper). In addition, Oregon's 1992 changepoint was preceded by the Measure 5 constitutional amendment in 1991, which limited local property tax rates and required the state to increase state education funding in order to replace lost property tax revenues. Colorado's 2003 changepoint was preceded by Amendment 23 [Colorado Funding for Public Schools Initiative] in 2000, which mandated various increases to state education funding. Both Oregon's and Colorado's constitutional amendments were initiated by state citizens (as opposed to initiation by the state legislature, as was the case in Michigan), suggesting that constitutional amendments offer another means through which citizens can influence state education spending outside of the courts.

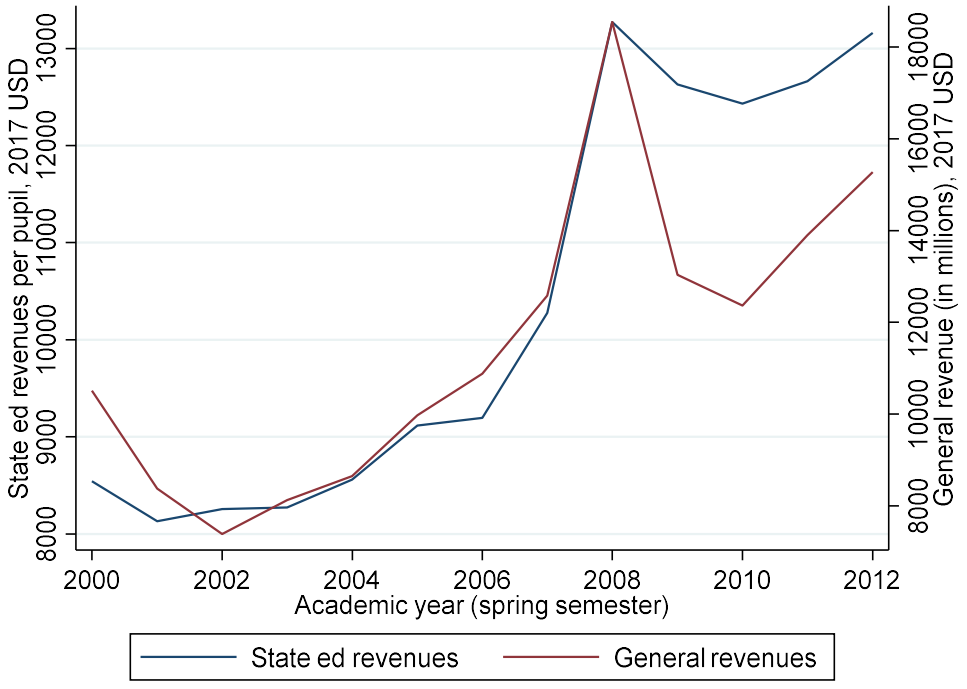
Resource Shocks: The Case of Alaska

As mentioned previously, we found that only 1 of the 39 changepoints (3%) was *not* preceded by legislative activity, but rather a resource shock. This one changepoint occurred in Alaska in 2006. Alaska is unique in that 80-90% of their general fund revenues comes from taxes

[78] See Appendix B for other examples of legislative activity following unsuccessful court cases, including New Mexico's 1994 changepoint, South Dakota's 1997 changepoint, and Vermont's 2005 changepoint.

and fees on oil production (Silverstein et al., 2015). No other state in the nation is as highly dependent on resource/energy production for state revenues—and by extension, elementary-secondary state education funding. Changes in world oil prices and production have a major impact on Alaska's state budget and state aid for education. As shown in Figure 3 below, when state general revenues are increasing as a result of high oil prices and/or production, state education revenues also tend to increase. When state revenues decline as oil prices and/or production drops, so do state education revenues. In particular, Alaska experienced rising general and state education revenues from 2002-2008, which coincides with the 2006 changepoint in state revenues detected by the BEAST algorithm. We thus attribute Alaska's 2006 changepoint to a resource shock, specifically, rising oil prices and/or production. We also note that we did not

Figure 3. Alaska's state education & general revenues, 2000-2012



Note: Data on state education and general revenues was obtained from the Annual Survey of State Government Finances. The survey is collected by the U.S. Census Bureau and has been compiled into a panel dataset, the Government Finance Database, by Pierson et al. (2015).

find any evidence of a "policy change" (legislative activity, court activity, or a constitutional amendment) in Alaska in the years preceding the 2006 changepoint.

Discussion

This dissertation essay provides a description of the events preceding positive changepoints in state elementary-secondary education investments during the post-1990 adequacy era. Using a Bayesian time series decomposition algorithm, we find that 43 positive changepoints occurred across 35 states' time series in per pupil state revenues. In turn, we identified 68 key events that preceded 39 of the 43 (91%) positive changepoints. We find that legislative activity of some kind occurred prior to 97% of positive changepoints, suggesting that state legislatures play a key role in determining when and the extent to state investments in education are increased. However, we also find that legislative activity was often prompted by court activity. Court activity, followed by a legislative act, occurred prior to 20 of the 39 changepoints (51%). Such prevalence of court activity implies that state legislatures often do not significantly increase state education funding "willingly" or "out of the blue"; rather, they are pressured or outright required via court order to do so. Given that there are always other state priorities (e.g., higher education, state welfare, corrections, highways, etc.) competing with elementary-secondary education for state funding, it is not terribly surprising that increased state education funding is often achieved or prioritized when state legislatures are forced to do so.[79]

We also find that, to a lesser extent, constitutional amendments and resource shocks preceded positive changepoints. Constitutional amendments occurred prior to 3 changepoints

[79] We note that positive changepoints which are preceded by court-prompted legislative activity are larger in magnitude by ~$200 per pupil compared to positive changepoints which are not preceded by court-prompted legislative activity, though these differences are *not* statistically significant.

(8%), while a resource shock only motivated 1 changepoint (3%). Although these two types of events were not as prominent as legislative and court activity in promoting changepoints in state education revenues during the adequacy era, their ability to impact state education revenues should not be disregarded. Most notably, citizen-initiated constitutional amendments offer an alternative path to citizens for increasing state education funding besides filing litigation against state governments. Interestingly, the impact of resource shocks on Alaska's state budget has led to recommendations that the state reduce their reliance on oil production for state revenues (see Silverstein et al., 2015).

Comparisons with SFR Lists

In total, we identified 42 legislative activity events and 22 court activity events that occurred prior to changepoints in state education revenues. Because lists of SFRs used in other studies are also overwhelmingly comprised of court orders and legislative acts, one may wonder the degree to which the events identified as preceding changepoints overlap with the court orders and legislative acts included on such lists. In other words, are we identifying the same acts and court orders that are commonly labeled as SFRs, or are we identifying other events that aren't typically considered to be SFRs? To examine this, we documented which events that preceded changepoints were also included on well-known and used SFR lists that cover the adequacy era. Specifically, we compared the SFR lists from Jackson et al. (2016), Lafortune et al. (2018), and Shores et al. (2021) to our list of events in Appendix Table B1.[80] Events that "match" with SFRs included on any of the three aforementioned lists are noted as doing so in the last column of Appendix Table B1.

[80] Jackson et al. (2016) includes court rulings related to school finance that occurred between 1971-2010. Lafortune et al. (2018) includes court rulings and legislative acts that occurred between 1989-2011. Shores et al. (2021) includes court rulings and legislative acts that occurred between 1989-2011.

Of the 64 events listed in Appendix Table B1 that are considered legislative or court activity, only 17 (27%) were also included on SFR lists. The majority of those 17 "matches" (10 out of 17; 59%) were court activity events, specifically, court rulings that ordered changes be made to states' school finance systems. The majority of events that did not match (35 out of 47; 75%) were legislative activity events. These rather low match-rates can be explained by the fact that lists of SFRs tend to focus on court rulings that overturn school finance systems rather than legislative acts.[81] Our finding that only roughly a quarter of the events identified as preceding changepoints are also included on other SFR lists suggests that such SFR lists should not be viewed as providing a comprehensive accounting of events that have motivated changes in state education funding. That these lists are non-comprehensive is troubling, especially when one considers that such lists are often used to determine which states should be considered "treated" or "control" in quasi-experimental studies of the effects of increasing education spending. As misclassification of treatment assignment can lead to biased effect estimates, future studies could leverage the more comprehensive list of events identified in this study to a) estimate the impact of increasing education spending and then b) examine whether previous effects estimated using traditional SFR lists are in fact biased.[82]

Limitations & Future Research

A few limitations of this study should be noted. Foremost, we recognize that our study does not identify causal relationships between events and positive changepoints in state education funding. Rather, our work is descriptive in nature and provides a succinct overview of the types of events preceding increases in state education funding. Future research should build

[81] Jackson et al.'s (2016) list of SFRs, which both Lafortune et al. (2018) and Shores et al. (2021) build off of when compiling their own SFR lists, is only comprised of court rulings.
[82] The authors are currently working on such a paper.

upon our work and estimate the causal impact of the identified events on state education funding.

Second, our study does not provide a comprehensive overview of all events preceding changepoints or a detailed description of the state contexts in which changepoints take place. While we chose to focus on identifying certain types of events in this study, we acknowledge that increasing state education funding is a complex process that involves many activities and actors, which are in turn influenced by state political, social, and economic contexts. Entire case studies focusing on just one of the 68 events highlighted in this study have been written.[83] We invite interested readers to seek out such work for more detailed information on specific events.

Lastly, we acknowledge that our study is narrow in focus: we specifically identify events preceding *positive* changepoints in state education revenues *during the adequacy era*. As such, we are unable to speak to what types of events precede *negative* changepoints, or what types of events precede changepoints *prior to* the adequacy era. Future research should identify such events in order to foster a more complete understanding of what motivates changepoints in state education funding.

[83] For example, Courant & Loeb (1997) provide a detailed case study of Michigan's 1994 Proposal A constitutional amendment; Lutz (2010) provides a detailed overview of New Hampshire's 1997 Claremont v. Governor II court ruling and 1999 House Bill 117; and Johnston & Duncombe (1998) provide a detailed overview of Kansas' 1991 Mock v. State pre-trial court opinion and 1992 School District Finance & Quality Performance Act [SDFQPA].

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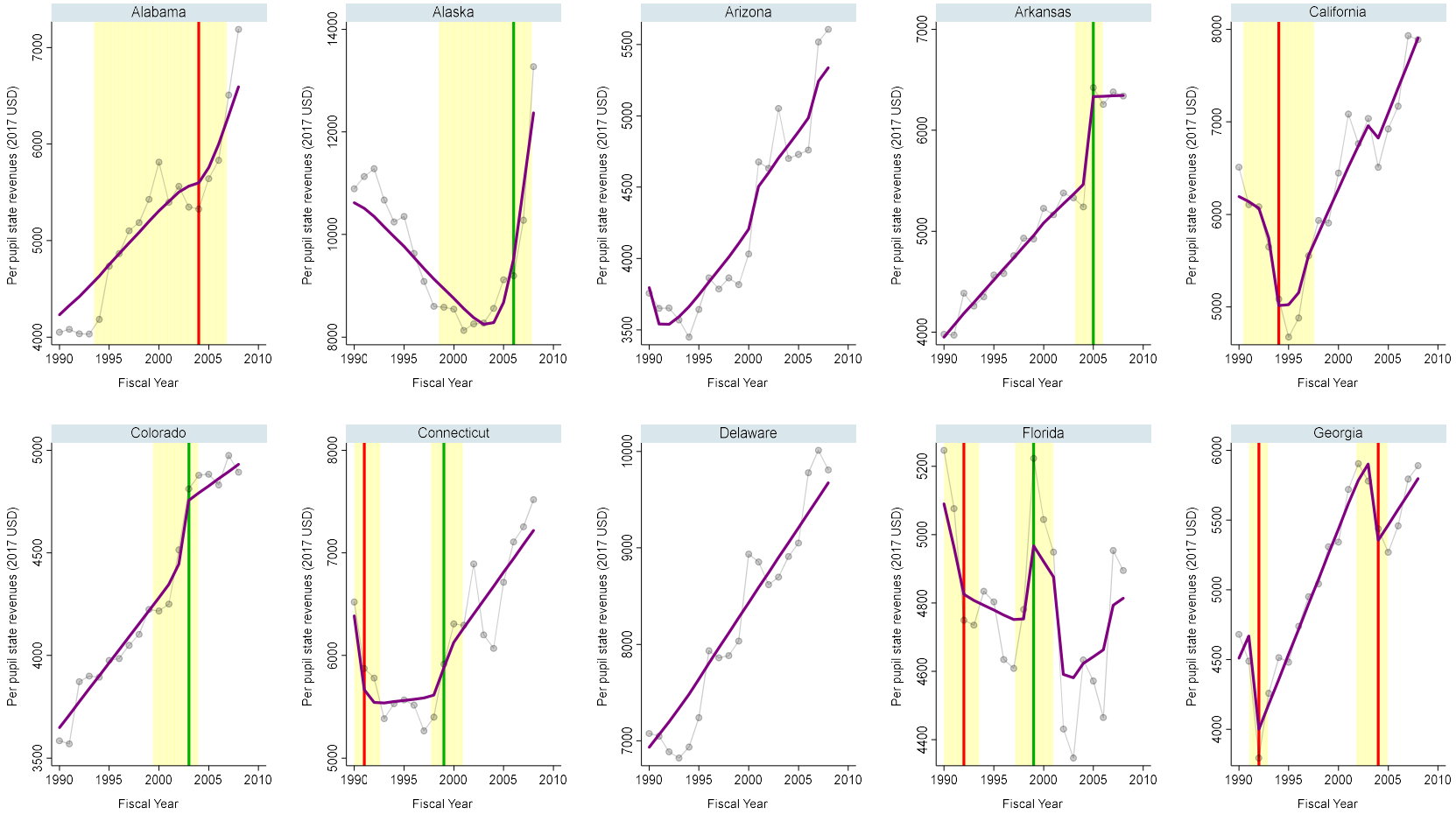
Appendix A: State-Specific Figures of Changepoints

Appendix Figure A1 (displayed on subsequent pages) visually depicts the occurrence of changepoints in each state's time series between 1991 and 2008. Grey dotted lines indicate per pupil state education revenues and purple lines indicate the fitted trend lines estimated by BEAST. Green and red vertical lines represent the years in which positive and negative changepoints occurred, respectively, and yellow background shading indicates confidence intervals associated with changepoints.

Appendix Figure A1. State-specific figures of changepoints, 1991-2008



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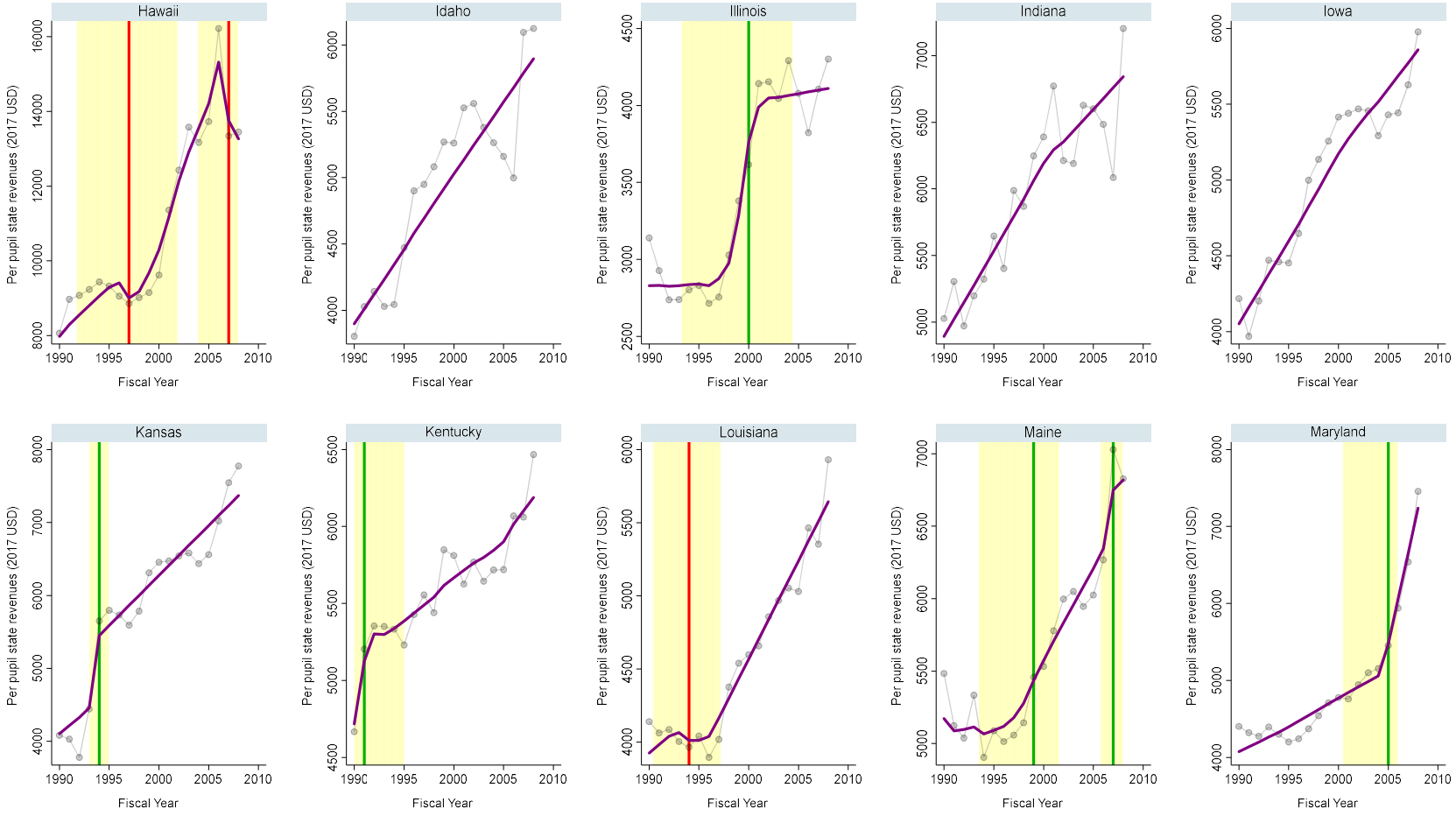
Appendix Figure A1. State-specific figures of changepoints–continued from previous page



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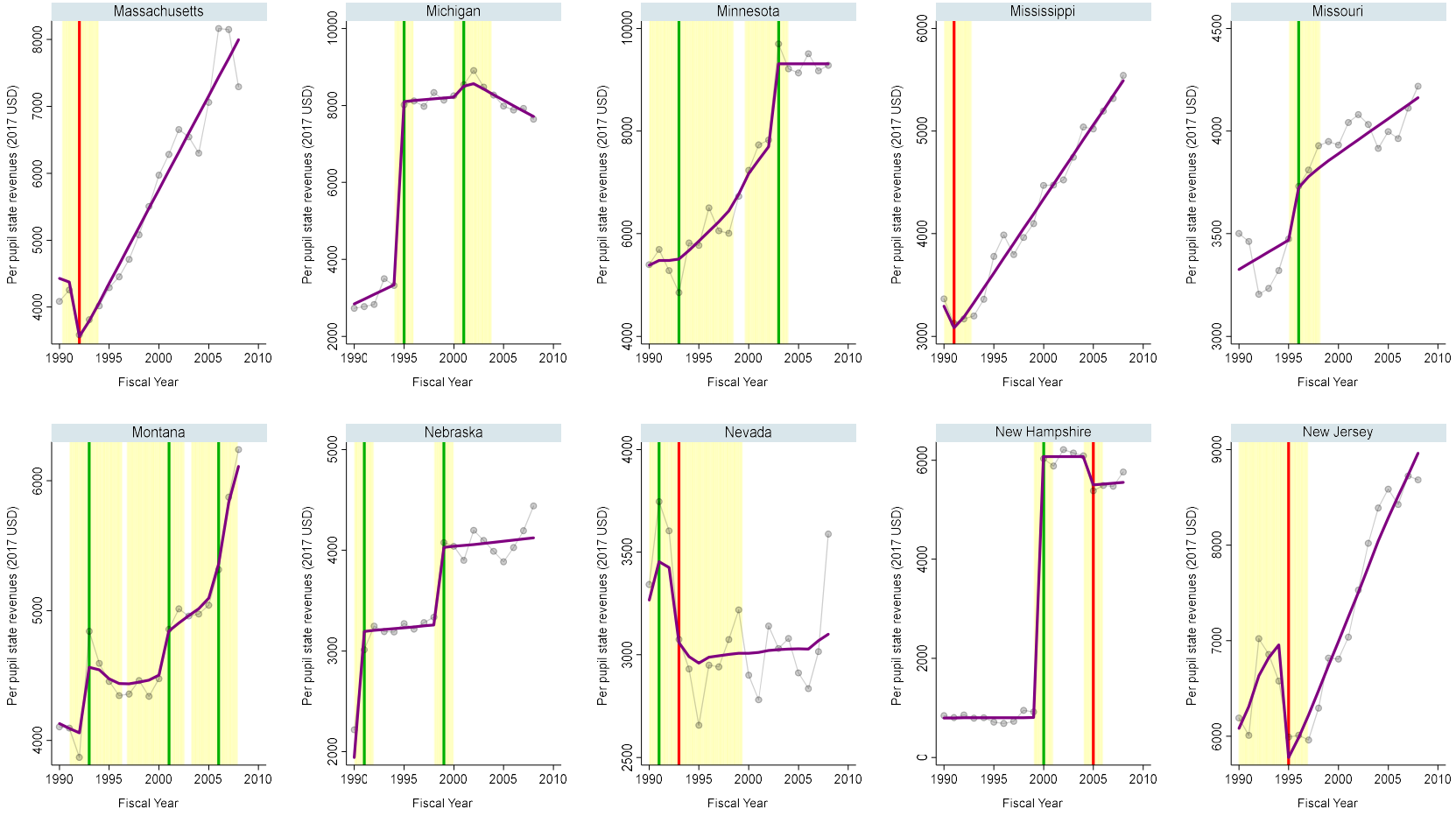
Appendix Figure A1. State-specific figures of changepoints–continued from previous page



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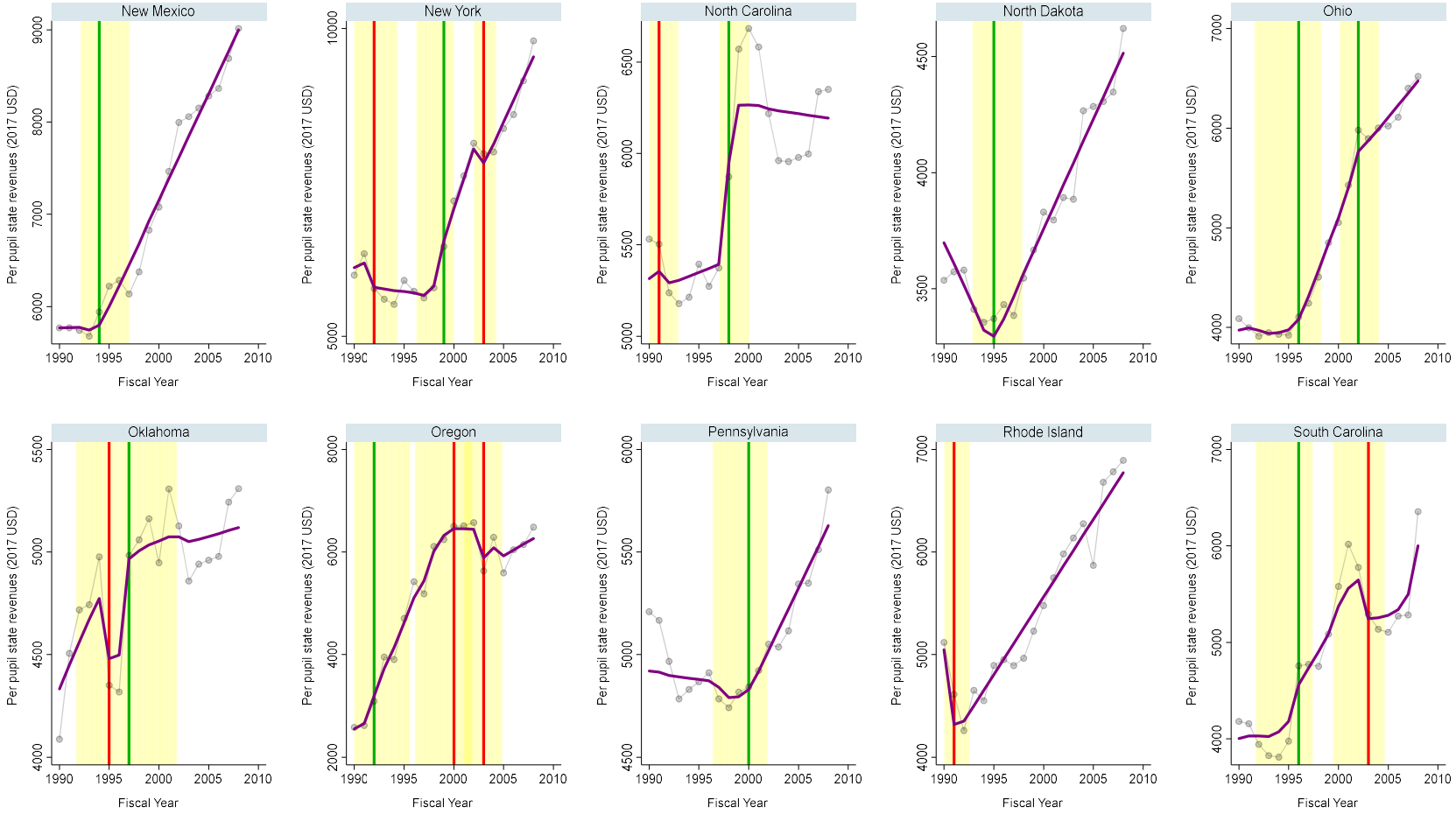
Appendix Figure A1. State-specific figures of changepoints–continued from previous page



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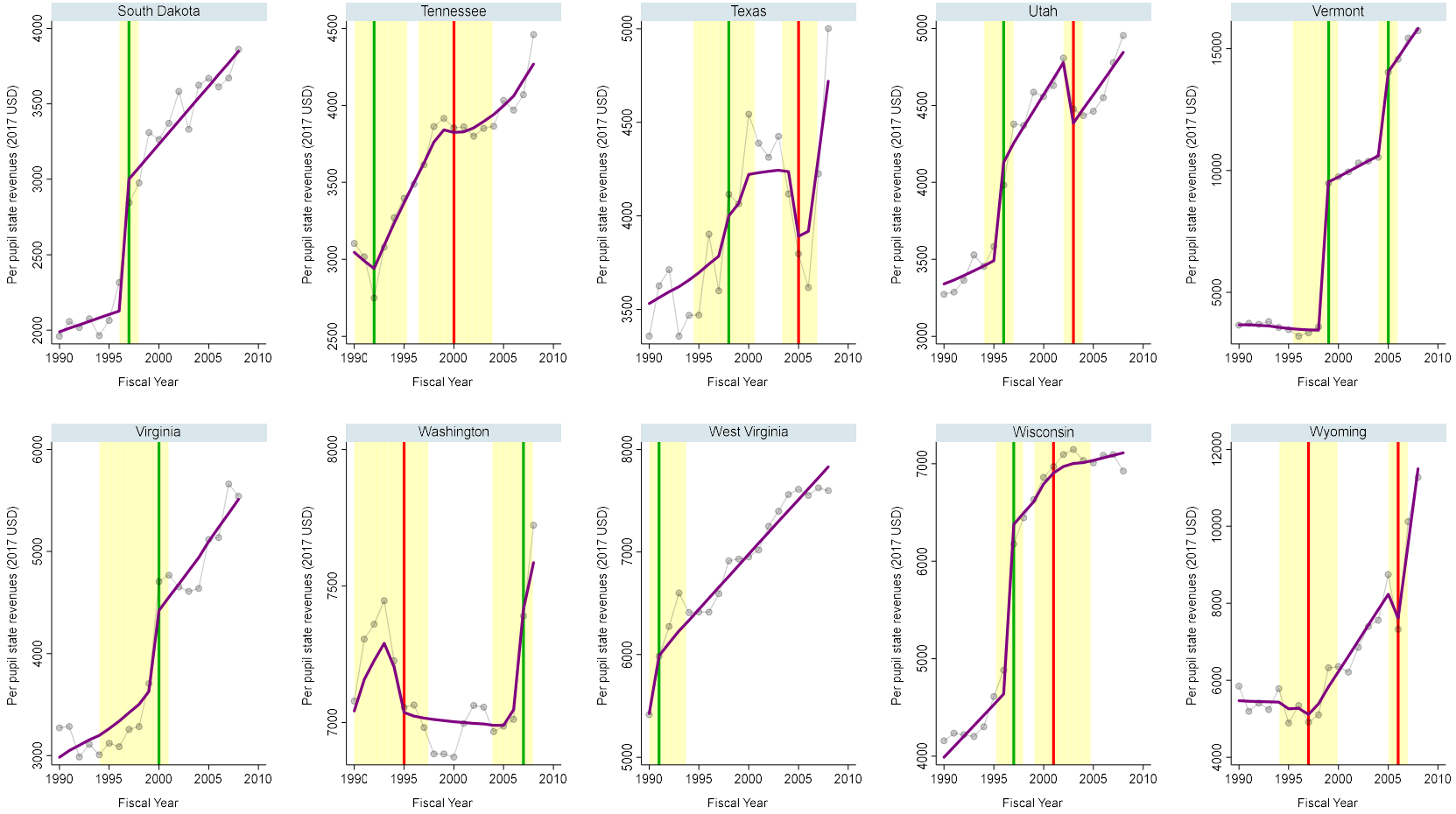
Appendix Figure A1. State-specific figures of changepoints–continued from previous page



Appendix B: List of Changepoints & Preceding Events

Appendix Table B1 (displayed on subsequent pages) lists all events found to be associated with the 43 positive changepoints during the adequacy era. The table also lists the date of the event, type of event (i.e., legislative activity, court activity, constitutional amendment, or resource shock), a brief event description, and whether the event is included on lists of SFRs used in other studies (specifically, Jackson et al. [JJP] (2016), Lafortune et al. [LRS] (2018), and Shores et al. [SCK] (2021)).

Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
State	**Year of changepoint**	**Event #**	**Event(s) preceding changepoint**	**Date of event**	**Type of Event**	**Brief event description**	**Event is included as SFR in LRS (2018), JJP (2016), or SCK(2021)**
Alaska	2006	1	Increasing oil production & prices	N/A	Resource Shock	Alaska experienced rising state education revenues in 2006 as a result of increased oil production and prices. Alaska is unique in that 80-90% of their general fund revenues comes from taxes and fees on oil production.	No
Arkansas	2005	1	Act 107 (Second Extraordinary Session, 2003)	2/2/2004	Legislative Act	Effective in March of 2004, Act 107 increased the state sales and use tax rate by .875 percent, expanded the services that state general sales tax applies to, and increased the wholesale vending tax in order to provide additional revenues for K-12 education	No
Colorado	2003	1	Giardino v. Colorado Board of Education, 2000	5/2000	Court Activity	Plaintiffs charged that deteriorating school facilities in some districts violated the constitutional guarantee of a "thorough and uniform system of free public schools." The State of Colorado agreed to a settlement in which they would dedicate $190 million to fund school repairs and construction.	No
Colorado	2003	2	Senate Bill 181	5/9/2000	Legislative Act	Bill appropriated $190 million for school construction over next 11 years to comply with *Giardino v. Colorado Board of Education* (2000) settlement. $5 million was appropriated in 2001, $5 million in 2002, and $10 million each year between 2003-2011.	Yes; LRS (2018), SCK (2021)
Colorado	2003	3	Amendment 23 [Colorado Funding for Public Schools Initiative]	11/7/2000	Constitutional Amendment	Amendment 23 mandated: increased state education funding for K-12 education for 10 years (increase funding by 1% each year); that the state provide a minimum level of funding based on student enrollment and inflation; the creation of the state education fund and that one-third of one percent of taxable income is dedicated to the fund	No

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
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Connecticut	1999	1	Sheff v. O'Neill, 1996	7/9/1996	Court Activity	Court ruled that the State was constitutionally obligated to provide students with a substantially equal educational opportunity and access to a public education which is not impaired by racial/ethnic isolation	Yes; JJP (2016), LRS (2018), SCK(2021)
Connecticut	1999	2	Public Act 97-290 [An Act Enhancing Educational Choices and Opportunities]	6/26/1997	Legislative Act	The act, which went into effect in July of 1997, called for additional spending on magnet schools, charter schools, voluntary interdistrict transfer programs and interdistrict co-operative programs in order to reduce racial/ethnic isolation. In subsequent years, the State increased education spending by $200 million (by $93 million in 1999 alone)	No
Florida	1999	1	House Bill 17-A [Public School Capital Outlay Program Act]	11/24/1997	Legislative Act	Under the act, the State agreed to spend a total of $2.7 billion in state bonding over five years to build and repair schools.	No
Illinois	2000	1	House Bill 452	12/4/1997	Legislative Act	The bill implemented changes to the state school funding formula via increased foundation levels starting in 1999. Specifically, the bill established a foundation level of $4,225 per pupil for 1999, $4,325 per pupil in 2000, and $4,425 per pupil in 2001.	No
Kansas	1994	1	Mock v. State (pre-trial opinion)	10/14/1991	Court Activity	Judge indicated in a pre-trial ruling that if the case went to trial, he would likely declare that the state school funding formula violated the state constitution's requirement that the legislature "make suitable provision for finance of the educational interests of the state."	No

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
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Kansas	1994	2	The School District Finance & Quality Performance Act [SDFQPA], 1992	5/20/1992	Legislative Act	Following the pre-trial ruling, the legislature implemented a new school funding formula via the SDFQPA. The SDFQPA established a foundation aid plan and also included a variety of special weightings or cost adjustments to accommodate differences in district characteristics and student enrollments. The SDFQPA also increased state education funding through raising state tax revenues while simultaneously reducing local property tax burdens by imposing a uniform local property tax rate .	Yes; LRS (2018), SCK (2021)
Kentucky	1991	1	Rose v. The Council for Better Education, Inc., 1989	9/28/1989	Court Activity	Court ruled that "Kentucky's entire system of common schools . . . [was] unconstitutional" and ordered the State to provide sufficient funding to enable an adequate education.	Yes; JJP (2016), LRS (2018), SCK(2021)
Kentucky	1991	2	House Bill 940 [Kentucky Education Reform Act]	3/24/1990	Legislative Act	In response to the court ruling, HB 840 was passed. The Bill implemented a new foundation funding formula that guaranteed each district a certain amount of funding per pupil. The Bill also mandated increases in the sales and income taxe rates in order to generate an estimated $1,127 million for education (75% of which would be dedicated to K-12) over the next two years (1991 & 1992)	Yes; LRS (2018), SCK (2021)
Maine	1999		Could not determine				

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
State	**Year of changepoint**	**Event #**	**Event(s) preceding changepoint**	**Date of event**	**Type of Event**	**Brief event description**	**Event is included as SFR in LRS (2018), JJP (2016), or SCK(2021)**
Maine	2007	1	Legislative Document 1 [LD l: An Act to Increase the State Share of Education Costs, Reduce Property Taxes and Reduce Government Spending at All Levels]	1/2005	Legislative Act	The legislation established the Essential Programs and Services (EPS) funding model, which went into effect in 2006. Using a cost analysis, the State establishes the amount, level and cost of education components needed in each school to ensure all students have equitable opportunities to achieve proficiency. The legislation also increased the State share percentage of the total EPS operating costs each year in order to reach a state share of 55% by FY 2009.	No
Maryland	2005	1	Bradford v. Maryland State Board of Education, 1996	10/18/1996	Court Activity	Court ruled that students in Baltimore City public schools are not receiving a constitutionally adequate education	Yes; JJP (2016), LRS (2018), SCK(2021)
Maryland	2005	2	Senate Bill 856 [Bridge to Excellence in Public Schools Act]	5/6/2002	Legislative Act	The Bill established a foundation grant program, as well as mandated a $1.3 billion increase in state education funding to be phased in over six years.	Yes; LRS (2018), SCK (2021)
Michigan	1995	1	Public Act 145	7/20/1993	Legislative Act	The Act exempted all real and personal property taxes from being used for school operating purposes beginning in 1995, thus eliminating ~64% of K-12 school funding.	No
Michigan	1995	2	Michigan Tax Amendment [Proposal A], 1994	3/15/1994	Constitutional Amendment	In response to Public Act 145, Proposal A raised the general sales tax rate and implemented a state property tax to fund schools. All revenues generated from the Proposal A tax increases were earmarked for the state School Aid Fund and then distributed by the state to school districts based on a foundation grant formula.	No
Michigan	2001	1	Durant v. State II, 1999	1999	Court Activity	Court ruled that its unconstitutional to require districts to spend a portion of their state foundation allowance to cover special education costs	No

Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
State	**Year of changepoint**	**Event #**	**Event(s) preceding changepoint**	**Date of event**	**Type of Event**	**Brief event description**	**Event is included as SFR in LRS (2018), JJP (2016), or SCK(2021)**
Michigan	2001	2	Public Act 297	7/26/2000	Legislative Act	This act replaced the foundation grant used after Proposal A with three separate payments to school districts: (1) payment for special education (2) foundation grant payment; and (3) a discretionary amount for any additional funding.	No
Minnesota	1993	1	1991 Legislation		Legislative Act	Effective beginning in 1993, the foundation program funding scheme was supplemented with referendum and debt service equalization. Specifically, state aid was provided to equalize a portion of the operating referendum levy and the debt service levy. In 1993, the state spent ~$13 million in referendum equalization aid.	No
Minnesota	2003	1	2001 Legislation		Legislative Act	During the 2001 legislative session, the state passed legislation that increased the foundation grant per pupil by 13% (effective starting in 2003). Another 2001 bill essentially eliminated the statewide general education property tax levy (effective starting in 2003). The revenue that school districts lost was replaced with a large increase in state operating aid. As a result of these two bills, state education funding increased by ~$1.7 billion in 2003 (an increase of 40%).	No
Missouri	1996	1	Committee for Educational Equality v. State, 1993	1/1/1993	Court Activity	Court order declared the funding system unconstitutional and held that the state must provide the same educational opportunity to children living in rich and poor districts	Yes; JJP (2016), LRS (2018), SCK(2021)
Missouri	1996	2	Senate Bill 380 [Outstanding Schools Act]	8/1/1993	Legislative Act	Following the 1993 court ruling, SB 380 enancted a foundation funding formula. In addition, the Bill increased school funding and improved funding equity by raising taxes.	Yes; LRS (2018), SCK (2021)

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
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Montana	1993	1	Chapters 13, 14, and 17, Special Laws of January 1992.	Jan 1992	Legislative Act	The January 1992 Special Session of the legislature appropriated $16.1 million in "one-time" revenue to the state education fund for FY 1993	No
Montana	2001	1	Senate Bill 100	March 1999	Legislative Act	The Bill increased basic per district and per pupil entitletiments from the state in FY 2000 and 2001. The per district entitlement for elementary districts increased from $18000 in 2000 to $18540 in 2001, and the per district entitlement for secondary districts increased from $200K in 2000 to $206K in 2001. The per pupil entitlement for elementary students increased from $3529 in 2000 to $3763 in 2001, and the per pupil entitlement for secondary students increased from $4821 in 2000 to $5015 in 2001.	No
Montana	2006	1	Columbia Falls Public Schools v. State, 2005	3/22/2005	Court Activity	A district court ruled that the existing state funding system was not constitutional and upon appeal, the Montana Supreme Court upheld this decision.	Yes; JJP (2016), LRS (2018), SCK(2021)
Montana	2006	2	2005 Legislation	2005	Legislative Act	The 2005 state legislature's appropriation for state education funding was $30.5 million higher in 2006 compared to 2005. In contrast, the appropriation for state ed funding was only $4.2 million higher in 2005 compared to 2004	No
Nebraska	1991	1	Legislative Bill 940	1988 (calendar year)	Legislative Act	Bill created the School Financing Review Commission. The commission was tasked with performing an in-depth study on school finance and producing recommendations for change.	No

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
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Nebraska	1991	2	Filing of Gould v. Orr	filed in Jan 1990	Court Activity	Filed in Jan. 1990, plaintiffs argued that Nebraska's statutory scheme for financing public schools denied students equal protection of the law, equal and adequate educational opportunity, and uniform and proportionate taxation.	No
Nebraska	1991	3	Legislative Bill 1059 [Tax Equity and Educational Opportunities Support Act (TEEOSA)]	4/9/1990	Legislative Act	TEEOSA established an equalization funding formula, as well as raised state sales and income taxes to fund increased education spending and enable reduction of local property tax rates	No
Nebraska	1999	1	Legislative Bill 806; Legislative Bill 806A (companion appropriations bill)	5/28/1997	Legislative Act	LB 806 altered the funding formula by calculating state aid at the system level (effective starting in 1999). The companion appropriations bill increased state aid to schools by $110 million in 1999.	No
Nevada	1991	1	Assembly Bill 964 [Class-Size Reduction Act]	7/6/1989	Legislative Act	The act was designed to reduce the pupil-teacher ratio in the public schools, specifically in grades K-3 and in classrooms where core curriculum is taught. The program was scheduled to proceed in several phases. The first phase, implemented in 1991, reduced the ratio in selected kindergartens and first grade classrooms at a cost of $16 million to the state.	No
New Hampshire	2000	1	Claremont v. Governor I, 1993	12/30/1993	Court Activity	Court ruled that the state has a constitutional duty to provide each child with an adequate education.	Yes; JJP (2016), LRS (2018), SCK(2021)

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Appendix Table B1. List of changepoints & preceding events

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New Hampshire	2000	2	Claremont v. Governor II, 1997	12/17/1997	Court Activity	Court ruled that the state education finance system was unconstitutional because it enabled inequitable local property tax rates and fostered inadequate educational opportunities. The court further declared that the state needed to define and fund an adequate education.	Yes; JJP (2016), LRS (2018), SCK(2021)
New Hampshire	2000	3	House Bill 117	4/29/1999	Legislative Act	Bill changed state school funding formula to a foundation program. The bill also established a statewide property tax and raised a variety of other state taxes in order to provide additional state education funding.	No
New Mexico	1994	1	New Mexico Lottery Act	April 1995	Legislative Act	The Act provides that the lottery contributes 60% of all net lottery proceeds to the Public School Capital Outlay Fund. Lottery began selling tickets in April 1996	No
New Mexico	1994	2	1996 court ruling	Feb 1996	Court Activity	The state provided additional funding to school districts with more than 10 thousand students through a density factor in order to compensate districts for higher costs associated with the education of at-risk students. In 1995, 10 medium-sized school districts filed a lawsuit against the state arguing that the density factor violated the New Mexico Constitution. In February 1996, the judge granted the defense's motion to dismiss the case.	No
New Mexico	1994	3	Senate Bill 100	1997 legislative session	Legislative Act	The Bill increased the state share of education funding to ~84 percent in 1998 (compared to ~74 percent of funding prior to 1997) and targeted more of these funds to at-risk students	No
New Mexico	1994	4	Zuni School District v. State, 1999	10/14/1999	Court Activity	Court ordered the state to "establish and implement a uniform funding system for capital improvements . . . and for correcting existing past inequities."	Yes; JJP (2016), LRS (2018), SCK(2021)

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Appendix Table B1. List of changepoints & preceding events

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New Mexico	1994	5	2001 Legislation	End of 2001	Legislative Act	The legislature created a $400 million standards-based public school capital outlay program, which was intended to establish a standards-based adequacy level for facilities in all districts.	No
New York	1999	1	Real Property Tax Law, Section 425 [New York State School Tax Relief (STAR) program]	8/7/1997	Legislative Act	Enacted in FY 1999, the law shifted a portion of local education tax burdens from individual school districts to the state. The program also includes a reduction in the New York City personal income tax (PIT) burden. STAR provides increased state funds to reimburse districts for the foregone tax revenue.	No
North Carolina	1998	1	North Carolina School Bonds Referendum (Referendum 1), Nov 1996	11/5/1996	Legislative Activity	The referendum, which was on the ballot as a legislatively referred bond question, issued $1.8 billion in state bonds to provide funds for public school capital projects. A max of $450 million could be disbursed each year in the first four years. The first year of allocation was 1997, but most allocations to districts started in 1998.	No
North Dakota	1995	1	Bismarck Public School District No. 1 v. State of North Dakota, 1993 (district court)	2/4/1993	Court Activity	District court ruled that the state school finance system was in violation of the state constitution	No
North Dakota	1995	2	House Bill 1003	5/5/1993	Legislative Activity	The Bill set per pupil state education funding at $1572 in 1994 and $1636 in 1995. The Bill also appropriated $70K towards a Legislative Council that would conduct an evaluation of the state education finance system	No

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Appendix Table B1. List of changepoints & preceding events

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North Dakota	1995	3	1995 Legislation (including Senate Bills 2059, 2063, and 2519)	1995 legislative session	Legislative Activity	The Legislature appropriated $40 million more for education across the 1996 & 1997 school years compared to the appropriation for the 1994 & 1995 school years. The most significant provisions were in the following three bills: Senate Bill 2519 set pupil state education funding at $1757 in 1996 and $1862 in 1997. Senate Bill 2059 increased transportation funding and Senate Bill 2063 provided that $10 million must be used to reimburse school districts for special ed costs	No
Ohio	1996	1	Filing of DeRolph v. Ohio	Jan 1992	Court Activity	Plaintiffs challenged the constitutionality of Ohio's school funding system on "equity" and "adequacy" grounds	No
Ohio	1996	2	House Bill 671	6/30/1992	Legislative Act	The Bill established an equity fund to provide increased state aid to low-income districts. The amount of funds increased from $43.75 million in 1993, to $90 million in 1996, to $100 million in 1997.	No
Ohio	2002	1	DeRolph v. State II, 2000	5/11/2000	Court Activity	Court rules that state school funding system is unconstitutional	Yes; JJP (2016), LRS (2018), SCK(2021)
Ohio	2002	2	House Bill 94	5/30/2001	Legislative Act	The bill changed the methodology for determining the base cost of an adequate education starting in 2002, resulting in increased base cost per pupil amounts (went from $4,294 per pupil in 2001 to $4,814 in 2002). The bill also implemented increased state education funding via parity aid and gap aid.	No
Oklahoma	1997		Could not determine				
Oregon	1992	1	Measure 5	11/6/1990	Constitutional Amendment	The amendment limited local property tax rates and required the state to "replace from the State's general fund any revenue lost by the public school system because of the limitations," effective in 1992	No

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Appendix Table B1. List of changepoints & preceding events

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Oregon	1992	2	Coalition for Equitable School Funding v. State, 1991	5/2/1991	Court Activity	Plaintiffs argued that the state education finance system violated the state constitution on "equity" grounds, but the court upheld the school finance system.	No
Oregon	1992	3	Senate Bill 814	1991 legislative session	Legislative Act	The bill created a new Equalization Formula for distributing state aid, which includes a base level amount per student and additional weights for specific categories. In addition, the bill allocated ~$9.6 million in state funds to local districts in 1992 to offset loss of local property taxes.	No
Pennsylvania	2000		Could not determine				No
South Carolina	1996	1	Filing of Abbeville County School District v. State	Nov 1993	Court Activity	In 1993, almost half of South Carolina's 91 school districts sued the State, alleging that the education finance system violated the state and federal constitutions and a state funding statute	No
South Carolina	1996	2	Act 145, Part II, Section 119A (General Appropriations Act for 1995-96 year)	06/29/1995	Legislative Act	The Act appropriated ~$200 million to fund property tax relief beginning in 1996. As a result, the state share of education funding shifted from 45 percent in 1995 to 51 percent in 1996	No
South Dakota	1997	1	Bezdichek v. State, 1994	Fall 1994	Court Activity	Plaintiffs argued that state school funding system does not meet the constitutionally guaranteed standard of uniform public education and that property taxes are not fair and uniform for school financing purposes. However, the court declared the state's education finance system constitutional.	No

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Appendix Table B1. List of changepoints & preceding events

Changepoint Information		Event Information					
State	**Year of changepoint**	**Event #**	**Event(s) preceding changepoint**	**Date of event**	**Type of Event**	**Brief event description**	**Event is included as SFR in LRS (2018), JJP (2016), or SCK(2021)**
South Dakota	1997	2	1995 legislation acts	1995 legislative session	Legislative Act	The Legislature revised the state school funding formula in the 1995 legislative session, to take effect January 1, 1997. The revised formula funded districts based on an established per student allocation (PSA), a district's enrollment, and the amount of local property tax levied. State education funding based on the formula is the largest source of revenue for local districts. In addition, the 1995 Legislature capped the local property tax levy.	No
Tennessee	1992	1	Filing of Tennessee Small School Systems v. McWherter I	7/7/1988	Court Activity	Plaintiffs asked the court to declare the old funding formula in violation of both the education and the equal protection clauses of the Tennessee Constitution and require the State to establish a new funding system that met constitutional standards.	No
Tennessee	1992	2	Education Improvement Act	3/11/1992	Legislative Act	The Act established the Basic Education Program (BEP) funding formula, which specifies the educational resources required to provide a basic level of education for all students. The Act also required that the state fund 75% of the cost of classroom components and 50% of costs of non-classroom components. Funding for the program was phased in over six years. Per pupil state education funding increased from ~$2750 in 1992, to ~$3000 in 1993, to ~$3500 in 1996.	Yes; LRS (2018), SCK (2021)
Texas	1998	1	House Bill 4	6/04/1997	Legislative Act	The Bill created the Instructional Facilities Allotment (IFA) program, effective September 1997. The IFA provided state funding to school districts to assist with debt service payments on qualifying bonds and lease-purchase agreements.	No
Utah	1996		Could not determine				No

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Vermont	1999	1	Brigham v. State, 1997	2/5/1997	Court Activity	Court ruled that the state's education finance system violated the equal protection and education clauses of the state constitution	Yes; JJP (2016), LRS (2018), SCK(2021)
Vermont	1999	2	Act 60 [Equal Educational Opportunity Act]	06/27/1997	Legislative Act	Effective in 1999, the act implemented a foundation funding program. The act also replaced funding of schools via local property taxes with a new statewide property tax and also increased other states taxes (room & meals, corporate income, motor fuels). As a result, state education funding dramatically increased in years 1999 and beyond.	No
Vermont	2005	1	Anderson and Stevens vs. State, 1998	12/22/1998	Court Activity	Plaintiffs from wealthier towns argued that the state school funding formula forced them to spend less on education than property-poor towns, creating unequal educational opportunity for their students. The case was dismissed by the court	No
Vermont	2005	2	Act 68	6/18/2003	Legislative Act	Effective in 2005, the Act split the homestead and non-homestead education property tax rates, as well as made a district's property tax rate proportional to the spending approved by its residents. After Act 68, all property taxes are considered to be under the "control" of the state. Act 68 also raised the general sales and use tax by 1 percentage point and dedicated one-third of the revenues raised from the sales and use tax to the state education fund.	Yes; LRS (2018), SCK (2021)
Virginia	2000	1	House Bill 1450 budget amendment	4/10/1999	Legislative Act	The Bill allocated 100 percent of State Lottery revenues in 2000 for local public school construction grants. Subsequently, in November 2000, Virginia voters approved of a constitutional amendment that mandated the creation of the State Lottery Proceeds Fund and that all proceeds from the lottery be expended for public education purposes in the future.	No

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Washington	2007	1	2005 Legislation	2005	Legislative Act	The legislature appropriated $139 million for salary increases (Initiative 72), $126 million for health benefits, $138 million for the student achievement fund (Initiative 728), $25 million for the Learning Assistance Program, and $19 million for special ed.	No
West Virginia	1991	1	1990 third special session legislation	Aug 1990	Legislative Act	The legislature approved a $5000 raise for teachers over next three years; established a faculty senate in each school, bought computers for classrooms, and approved a $60 million school construction bond	No
Wisconsin	1997	1	Act 27	7/26/1995	Legislative Act	Effective starting in 1997, the Act mandated that the state provide two-thirds funding of schools (the state was only providing 48% of funding in 1994). The Act also modified the state school school funding formula to a three-tiered equalization plan.	No