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The Journey to School: K-12 Student Transportation Policies and Travel Behavior

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The Journey to School:

K-12 Student Transportation Policies and Travel Behavior

A dissertation submitted in partial satisfaction of the

requirements for the degree of Doctor of Philosophy

in Urban Planning

by

Samuel Joseph Speroni

2026

ABSTRACT OF THE DISSERTATION

The Journey to School:

K-12 Student Transportation Policies and Travel Behavior

by

Samuel Joseph Speroni

Doctor of Philosophy in Urban Planning

University of California, Los Angeles, 2026

Professor Evelyn A. Blumenberg, Co-Chair

Professor Brian D. Taylor, Co-Chair

Every school day in the United States roughly 55 million students ages 5 through 18 set out on a journey to school. Many students in the U.S. live too far from school to walk. For these students, each state and school district sets policies about school bus service—including which students are eligible for it and who pays for it—which in turn affect the school travel options from which a family can choose. Researchers have studied how children travel on this journey, especially whether they walk or bike to school, but scholars have rarely considered how public policies and funding decisions about school transportation affect students' travel choices. To address this gap in the literature, my dissertation answers the following research question: To what extent are institutional factors, such as state and local school district policies about school bus eligibility and funding, associated with how students travel to and from school, controlling for student, school, and other relevant characteristics? I consider this question

broadly across the U.S. and specifically for California, using two novel datasets of the school transportation policies of the 50 U.S. states and 119 randomly selected California school districts. I link these policies to student travel behavior data from the 2017 National Household Travel Survey (NHTS). I also use travel behavior data from the 2001, 2009, 2017, and 2022 iterations of the NHTS to assess how school travel mode selection has changed over time.

This dissertation advances the literature on school transportation and travel by establishing the significant role of state and local policy in how families select travel mode. My research finds little practical change in how students commute to school from 2001 to 2022, a finding that departs from substantial changes in the three decades prior. Meanwhile, across the U.S., school transportation policies varied substantially from state to state. At the district level in California, a state without strong school transportation policy or funding, school district transportation policies varied widely in the absence of state requirements. State support (legislative and/or financial) for school bus service was associated with a downstream increase in students' use of the school bus. Far fewer California students were eligible for school bus service than students in the rest of the U.S. and, in turn, far fewer of them traveled by school bus. In all, I find that policy plays an important role in how students travel to school. In particular, state policy enables and encourages more students to use the school bus and fewer students to rely on private cars. For education policymakers, this dissertation can inform how state and district leaders create or amend school transportation policies and how they allocate resources toward these programs, all of which potentially improve equitable access to educational opportunities. These findings can also expand transportation planners' thinking about how to reduce automobile use—and in turn reduce greenhouse gas emissions and traffic congestion—by leveraging school bus service for children in addition to encouraging the use of public transit among adults.

The dissertation of Samuel Speroni is approved.

Michael C. Lens

Meredith Phillips

Evelyn A. Blumenberg, Committee Co-Chair

Brian D. Taylor, Committee Co-Chair

DEDICATION

For my students at Harding High School in Charlotte, 2011–2014.

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List of Acronyms and Definitions

ACS	American Community Survey
Caltrans	California Department of Transportation
CCD	Common Core of Data, from the U.S. Department of Education
CDE	California Department of Education
ESSA	Every Student Succeeds Act of 2015
ESSER	Elementary and Secondary School Emergency Relief (Fund)
FHWA	Federal Highway Administration
GHG	Greenhouse Gas (Emissions)
HTST	Home-to-School Transportation (Fund), in California
IDEA	Individuals with Disabilities Education Act of 1990
IEP	Individualized Education Program
NCES	National Center for Education Statistics
NHTS	National Household Travel Survey
SABS	Student Attendance Boundary Survey
Transit	Fixed-use, fixed-route public transit open to the general public (does *not* include school buses in this dissertation)
VMT	Vehicle Miles Traveled

Legend of Travel Modes

Throughout this dissertation, I will use the same color-coding scheme for travel modes.

Color	Travel Mode	Description
	Automobile (In-Household)	Only members of the household traveling in the same vehicle
	Automobile (Carpool)	Trip-taker in vehicle with people outside of their household
	School Bus	School-operated bus designed for and only open to students
	Walk	Walking only
	Bike	Bicycle only
	Public Transit	Fixed-route, fixed-schedule bus or train
	Other	Includes taxi, ridehail, ferry, golf cart, motorcycle, and others

Acknowledgements

The years-long joke around the UCLA Institute of Transportation Studies (ITS) office suite is that Sam loves to talk (at times at the expense of my efficiency, I'll admit). So, this hardly feels like the time to be reticent—this acknowledgements section is *extra* filled with words!

I am grateful for the financial support of this project from the John Randolph and Dora Haynes Foundation through the Haynes-Lindley Dissertation Fellowship, the UCLA Division of Graduate Education's Dissertation Year Award, and the UCLA ITS Dissertation Year Fellowship and Graduate Research Grant. Additionally, this project relied in part on data assembled or collected from two previous studies, one funded by the University of California Institute of Transportation Studies' Resilient and Innovative Mobility Initiative and another jointly funded by the Pacific Southwest Region University Transportation Center and the California Department of Transportation (Caltrans).

Secondary data for this project came from the Federal Highway Administration's National Household Travel Survey (NHTS) program and the Caltrans-funded NHTS California Add-On. I want to be sure to thank the people who designed, conducted, and participated in these surveys, who are too often left out of research thank-yous. The California data are housed by the National Laboratory of the Rockies' Transportation Secure Data Center, and I am grateful for technical support there from Cemal Akcicek and Jeff Cappellucci. My primary data were only possible through the efforts of my three ultra-talented research assistants over the past four years: Sophia Balkovski, Samea Derrick, and Monisha Reginald.

I am eternally grateful for the expertise, mastery of university bureaucracy, and moreover, the extraordinary kindness of the staff at UCLA ITS and its sister institute, the Lewis Center for Regional Policy Studies, including Maddie Brozen, Claudia Bustamante, Phoebe Chiu, David Islas, Juan Matute, Georgi Prevost, Jacob Wasserman, and Whitney Willis. ITS director Adam Millard-Ball graciously allowed me to use his director's office on weekends and breaks, and a sizable portion of this dissertation was written in that distraction-free space. And in the UCLA Urban Planning department office, graduate adviser Brandon Basa has somehow had a quick and helpful solution every time I have needed one.

I have been graced by extraordinary colleagues at UCLA ITS who have made me a better scholar and better human, including tamika butler, Yu Hong Hwang, Amy Lee, Julene Paul, Fariba Siddiq, and Madeline Wander. I especially want to thank Amy for arriving at UCLA as a postdoc willing to share a freshly-printed roadmap for how to complete an excellent dissertation, bumpy spots and all—something I unknowingly but badly needed. tamika, Madeline, and I have met for coffee and coworking one day a week for about four consecutive years; those days have kept me together during this process. Finally, one important footnote to this list of staff and colleagues: I am also thankful for the support of these friends' partners and children, who were not only supportive of their own family member but of me, too.

Academic friends are often mentioned in these types of spaces, but I feel compelled to thank my non-academic friends, too; in many ways, those above signed up for hearing me drone on about transportation—but the people below did not, and they still put up with me anyway. I am especially indebted for a decade (or more) of friendship and support from Nicole Favret, Maggie Jordan, Mike Pimentel, Meagan Wang, and Caroline Wolek. I am deeply thankful for the support of David Al-Hakeem, Matt Bindel, Sydnee Cicoria, Jeff Gonzalez, Katie Kennedy, Nikki Nero, and Alec Turner throughout the dissertation process. The regulars and staffs at Bodega, O'Brien's, and Sonny McLean's in Santa Monica always had space for my laptop and me. And I send thanks to my parents, Kathy and Joe, for their support of my education (and my educating others) since day one, and to my sister Jeanne, my brother-in-law Hank, and their dog Ahsoka, whose home in Tucson has a guest room desk so I could bring my work with me and thereby visit more often.

I have been beyond fortunate to have somehow had several once-in-a-lifetime mentors in my life, both prior to and at UCLA (more on the latter in a moment). I am forever grateful for Laura Carlyle, Pat Malone, and Marc Solomon for changing how I see myself and the world. I also thank GranVille Caldwell and Christine Robertson for showing me how to be an empathetic educator while maintaining high expectations for and belief in kids.

This dissertation is dedicated to my students at Harding High School in Charlotte, North Carolina, whose education leaders placed them at extreme disadvantage. Their triumphs over those disadvantages remain inspiring to me even all these years later. I owe special thanks to Destiny Guzman and Paloma Figueroa, who have continued to include me in their lives as they've grown up and have become my dear friends along the way.

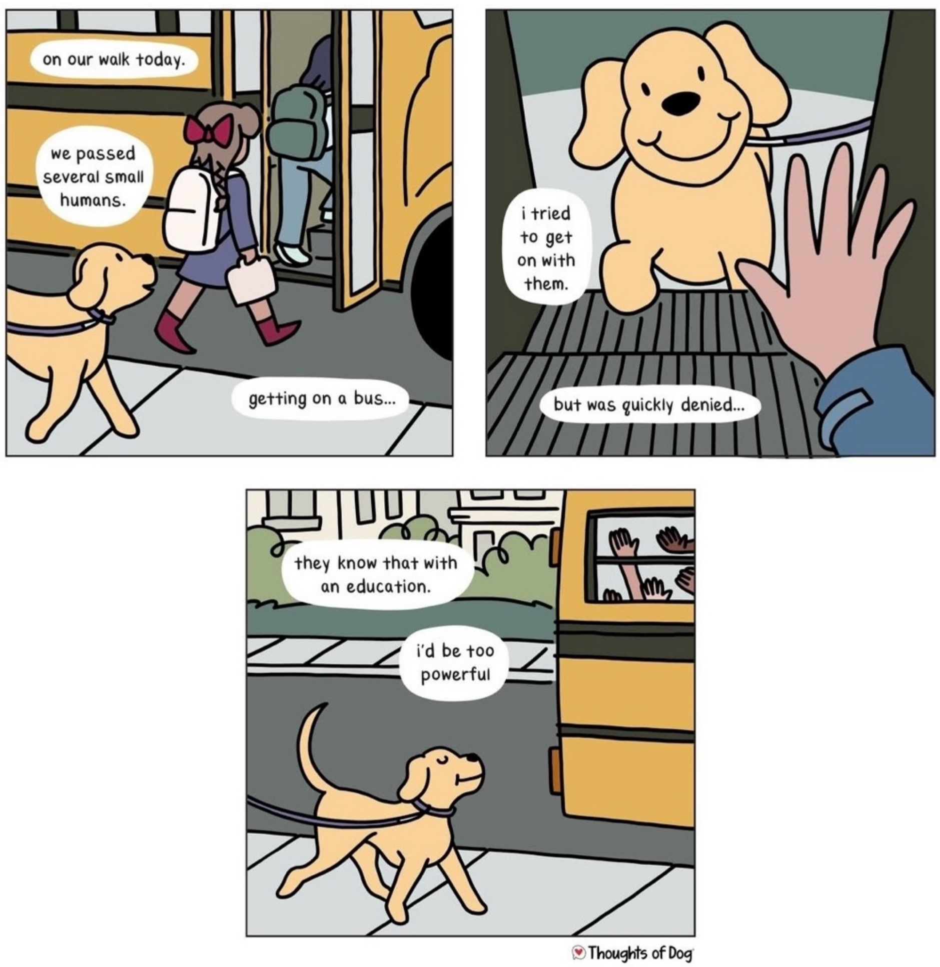
As I put this project together, several scholars contributed above and beyond their calls of duty. Ariel Bierbaum, Sarah Lenhoff, Bill Purdy, and Jeremy Singer all volunteered their expertise as education scholars to help shape how I thought about school transportation in the education context. I am also grateful for Kevin Gerson at the UCLA Law Library and Andy Lin at the UCLA Office of Advanced Research Computing for their help in resource access and statistical consulting, respectively. And collaborating with Eric Morris for the past several years has greatly shaped my approach to quantitative analysis and communicating research.

For this dissertation directly and all that came before it, I thank my committee. I cannot imagine a more supportive, kind, caring, and genuine group of five scholars who supported this dissertation and the lead-up to it. Although Martin Wachs sadly passed away during the early years of my PhD program and thus was not officially a member of my dissertation committee, his influence on this dissertation—and me—certainly lived on. Marty was unendingly generous with his sage wisdom, and his belief in my abilities will forever be a source of confidence for me. Meredith Phillips joined my committee as the outside field member earlier than is typical and agreed to do so because we share a belief that if something can be good for kids then it's worth doing. I remain in awe of Meredith's generosity of time, support, and mentorship over the past several years. Meredith also told me I should learn everything I could about neighborhoods and schools, so I turned to UCLA Urban Planning's resident neighborhood expert, Michael Lens, to fill out my committee. Mike has been a constant force of positivity during my time in the department and on my committee, and I am grateful for all his input and encouragement.

Finally, I am who I am as a scholar because of my dissertation committee co-chairs and co-advisers for the past eight years: Evelyn Blumenberg and Brian D. Taylor. Evy's warmth, care for her students, and enthusiasm for research that changes the world were evident from the first day we met and have never once waned over our time together. Brian has been the perfect blend of mentor for me: a motivator in times good and bad, an ardent cheerleader for my research (even for this somewhat obscure topic), a sharp eye for detail, and *just* the right amount of demanding to keep me on track. Having either Evy or Brian as a mentor would be an unbelievable stroke of luck for any doctoral student. I got to be mentored by *both* of them, and my appreciation for that—and for them—will never run out.

Preface

The below comic strip was released through the Thoughts of Dog social media channels just days before I filed this dissertation. I cannot imagine a more fitting (and succinct) description of what the next 245 pages communicate. There are few things more powerful than an education; even this dog knows that it begins with access to the school bus.



(Thoughts of Dog, 2026)

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2025 Lenhoff, Sarah Winchell, and **Samuel Speroni**. "School Transportation." *Live Handbook: Education Policy Research*, ed. Douglas N. Harris. Association for Education Finance and Policy (AEFP).

2024 Morris, Eric A., **Samuel Speroni**, and Brian D. Taylor. "Going Nowhere Faster: Did the Covid-19 Pandemic Accelerate the Trend Toward Staying Home?" *Journal of the American Planning Association*.

2024 Blumenberg, Evelyn, **Samuel Speroni**, Fariba Siddiq, and Jacob Wasserman. "Putting Automobile Debt on the Map: Race and the Geography of Automobile Debt in California." *Transportation Research Part A: Policy and Practice*.

2024 Blumenberg, Evelyn, Fariba Siddiq, **Samuel Speroni**, and Jacob Wasserman. "Driving A-Loan: Automobile Debt, Neighborhood Race, and the COVID-19 Pandemic." *Transport Policy*.

2024 Blumenberg, Evelyn, and **Samuel Speroni**. "Employment Concentration, Dispersion, and the Changing Commute in the San Francisco Bay Area." *Journal of Transport and Land Use*.

2024 **Speroni, Samuel**, Fariba Siddiq, Julene Paul, and Brian D. Taylor. "Peaked Too Soon? Analyzing the Shifting Patterns of PM Peak Period Travel in Southern California." *Travel Behaviour and Society*.

2023 Morris, Eric A., **Samuel Speroni,** and Brian D. Taylor. "Going Nowhere Fast: Might Changing Activity Patterns Help Explain Falling Travel?" *Journal of Transport Geography*.

2023 **Speroni, Samuel.** "Who Takes the School Bus? The Roles of Location, Race, Gender, and Parents in Choosing Travel-to-School Mode in Georgia." *Transportation Research Record*.

2023 Agrawal, Asha Weinstein, **Samuel Speroni**, Brian D. Taylor, and Michael Manville. *Pay-As-You-Go Driving: Examining Possible Road-User Charge Rate Structures for California*. Mineta Transportation Institute, San José State University.

2023 Siddiq, Fariba, Jacob Wasserman, Brian D. Taylor, and **Samuel Speroni**. "Transit's Financial Prognosis: Findings from a Survey of U.S. Transit Systems during the COVID-19 Pandemic." *Public Works Management & Policy*.

2022 **Speroni, Samuel,** Asha Weinstein Agrawal, Michael Manville, and Brian D. Taylor. *Charging Drivers by the Gallon vs. the Mile: An Equity Analysis by Geography and Income in California*. Mineta Transportation Institute, San José State University.

2022 **Speroni, Samuel,** Brian D. Taylor, and Yu Hong Hwang. "Pandemic Transit: A National Look at the Shock, Adaptation, and Prospects for Recovery." *Pandemic in the Metropolis:*

Transportation Impacts and Recovery, eds. Anastasia Loukaitou-Sideris, Alexandre Bayen, Giovanni Circella, and R. Jayakrishnan. Springer.

2022 Blumenberg, Evelyn, Fariba Siddiq, **Samuel Speroni**, and Jacob Wasserman. "Race, Income, and Auto Debt." *Pandemic in the Metropolis: Transportation Impacts and Recovery*, eds. Anastasia Loukaitou-Sideris, Alexandre Bayen, Giovanni Circella, and R. Jayakrishnan. Springer.

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2021 Excellence in Innovation / Research Award, Young Professionals in Transportation (YPT) International (with Tianxing Dai, Maya Desai, Eric Desmalchi, Hao Ding, John Gahbauer, Yu Hong Hwang, Julene Paul, and Brian D. Taylor).

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2011 Artemis & Martha Joukowsky Post-Graduate Scholarship, Brown University Dean of the College and Department of Athletics.

Part 1: Introduction, Background, and Approach

1. Introduction

Every school day in the United States, roughly 55 million students ages 5 through 18 set out on a journey to school (National Center for Education Statistics, 2023). They represent 16 percent of the total U.S. population (U.S. Census Bureau, 2024) and account for 10 percent of all vehicle trips on U.S. roadways during the morning peak travel period. In many ways, school commutes mirror adult commutes: they originate at home and travel elsewhere to the same location most days. These trips are routine, and families tend to plan around them. What separates the school commute from the adult work commute, however, is the role of the school bus. While driving has long been the dominant mode in adult commuting in the United States (91% of person trips), school commutes are divided between two major means of travel: the car (only 41% of trips in 2022) and the school bus (37%). Compared with the share of public transit trips for adults (4%), the difference is striking. In some ways, this is expected—most schoolchildren cannot drive themselves or purchase cars. But conversely, their parents/caregivers typically can drive, and nevertheless they rely heavily on school-provided transportation for their children. In fact, the otherwise-humble yellow school bus is the most-used form of shared mobility in the United States—more than the riders of every subway, light rail, and public transit bus service in every city combined (Speroni, 2023).

But while school transportation is a large part of U.S. transportation and a sizable portion of U.S. education expenditures, this is *not* a study of school transportation as a writ large phenomenon. It is a study of how state and local institutions may shape the opportunities available to students and their families—both in terms of transportation opportunities and the educational opportunities transportation can unlock. The availability of school buses for students has implications for student attendance, student access to choice school programs, family time availability and parental chauffeuring burdens, peak-hour traffic congestion, and greenhouse gas emissions. Meanwhile, a lack of school bus availability has equity implications, consigning children without private vehicle access to less time-efficient means of commuting to school. This study has implications for the transportation system *and* the education system. The problem is that we still know remarkably little about the connection between school transportation *policy* and school *travel*.

Despite the importance of these institutional decisions, for the past century, school transportation has occupied a sort of "no-man's land" of academic research, falling largely outside the principal domains of research in education policy, transportation policy, and urban planning. This disciplinary divide has created a blind spot in our understanding of school travel, but the gap is nevertheless logical. Education scholars, policymakers, and practitioners are concerned with educational outcomes. They have built extensive literatures on teacher certification and effectiveness, school finance, and public-school choice. Transportation planning and engineering counterparts, in contrast, are focused on transportation outcomes. Indeed, there are entire academic journals devoted to the study of public transportation. But almost silently—at least silently to the transportation field—educators operate a national fleet of school buses that is double the size of the national fleet of public transit trains and buses (Burgoyne-Allen & O'Neal Schiess, 2017; Grava, 2003).

School transportation on the whole is a research gap, but among the comparatively few existing studies, there is a deeper gap: scholars have devoted comparatively little attention to how state and local school transportation *policies* shape the lives of young people and their families. Existing research about school commutes has largely either modeled student outcomes (mostly attendance) on the assumption that all students use a given means of travel or modeled student travel choices while treating transportation opportunities as fixed. Instead, in this dissertation I treat transportation opportunities themselves as institutional outcomes and, in turn, as inputs to travel choices. State and local policies determine which transportation options are available to students, and those opportunities, in turn, shape the travel choices that students and families make.

To address this gap, I explore three research questions: First, given that the academic literature has established that school travel changed dramatically during the late 20th century, has school travel changed in the first quarter of the 21st century? Second, given that school transportation is governed by state and local school district policies about school bus service offerings, funding, and transportation user fees paid by families, what factors explain the variations in these policies across states and across districts? And finally, third, to what extent are these policies associated with elementary and secondary school students' selections of their means of travel to and from school? I examine school transportation policy and travel behavior at both the state and district levels using policy datasets I assembled about the 50 U.S. states and a sample of California school districts, which I link to nationally- and state-representative travel data from the National Household Travel Survey (NHTS).

Understanding these relationships is critically important amid converging crises across academic and policy disciplines. In the wake of the COVID-19 pandemic, education policymakers face three relevant challenges. First, student attendance remains a significant concern, especially in low-income schools (Lenhoff & Singer, 2025), and scholars have demonstrated a relationship between eligibility for school buses and lower rates of chronic absenteeism (Edwards, 2022; Gottfried, 2017). Second, despite the demonstrated benefits of school bus provision, many districts have had difficulty staffing them. A nationwide school bus driver shortage has persisted from before the pandemic and continues today (Carey & Phillips, 2025; Lieberman, 2021). And third, between 2021 and 2024, most school districts received an influx of federal funds from the Elementary and Secondary School Emergency Relief (ESSER) Fund to pay for programs that ameliorate pandemic-induced learning loss. Transportation programs were an eligible expense under ESSER, including regular school bus service, transportation to enrichment and after-school activities, and reimbursements to families for providing their own transportation (California Department of Education, 2025a). The federal government required these funds to be allocated by late 2024 and spent by mid-2026, causing many districts to face fiscal cliffs (LeFebvre & Master, 2024; Roza & Silberstein, 2023). Many districts have come to rely on the staff and programs funded by ESSER, especially with slower-than-hoped-for recoveries in student achievement and attendance. The loss of these one-time funds has left district officials to weigh eliminating these relatively new staff and programs or keeping them while eliminating pre-pandemic staff and programs. These decisions include deciding whether and how to proceed with transportation, as districts could have used ESSER funds to either fund existing transportation services (including driver retention bonuses amid the bus driver shortage) or offer additional transport services (BusPlanner, 2024; Craven, 2024; HopSkipDrive, 2026).

Similarly, transportation planners and engineers are contending with an upending of daily travel norms as we have long known them. During the 21st century people are spending more and more time at home and readjusting their outside lives in response, a trend the pandemic significantly accelerated (Morris et al., 2023, 2024). This shift has implications for households and communities alike. Many parents/caregivers now have more flexibility in their daily schedules, which could have two opposing forces on school travel: parents have more time to escort their children to school but are simultaneously now less likely to have a work commute as part of which they have often dropped off their children at school. Perhaps parents are now more likely to walk with or drive their children to school because of this flexibility; alternatively, they may view the school bus as more of a resource now that they do not have other reasons for leaving their homes. More broadly, these trends are leading to changing uses of roadways, public space, and public transit, especially changes in peak-period uses. Together, these challenges have renewed attention to school transportation at a moment when policymakers have little empirical evidence about how school transportation policies affect student travel behavior.

This dissertation makes four primary contributions. First, I document changes in national school travel from 2001 through 2022, continuing the work of prior scholarship rooted in changes from 1969 through 2009 (McDonald et al., 2011). Second, I create and analyze what I believe is the first systematic dataset of state school transportation policies. Third, I develop and analyze the first similar dataset of California district transportation policies, allowing me to leverage district-level policy variation where statewide guidelines are lacking. And fourth, I link institutional policies directly to student travel behavior. The findings of this research can help education and transportation policymakers understand the role of state and school district policy in determining how students travel to and from school, including how policy can make the school transportation system more equitable and efficient.

1.1. Definitions

As I explain more in the next chapter, this dissertation sits at the intersection of two areas of scholarship: transportation planning and education policy. Accordingly, it is important that I establish three key concepts and definitions before I begin in earnest.

Throughout this dissertation, I define school transportation policy as the collection of state and/or local rules governing the provision of school bus service. This includes what transportation services are provided, if they are legally required, how those services are funded, who is eligible for transportation services, and whether districts can charge user fees for student use of the services. These policies collectively determine the transportation opportunities available to students and their families and represent the institutional focus of the dissertation.

Second, transportation scholars often analyze travel mode choice, or the means of transportation by which people travel (Ewing et al., 2004; S. He, 2011; Kontou et al., 2020; McDonald et al., 2011). This choice of travel mode is the centerpiece of this dissertation. With school transportation, there are five principal travel modes: the automobile, the school bus, walking, biking, public transit. For automobile travel, I divide it into two categories: (1) automobile use with only members of a student's household, and (2) auto use with at least the student and at least one person who is *not* a member of the student's household. While both of these cases are technically "carpooling," I use this term in this dissertation only to refer to the second case where the trips include at least one person outside of the household—the idea being that trips coordinated with other households are fundamentally different from those coordinated within a single household. For public transit, I define this to exclude yellow school buses, as is the norm in transportation planning practice; "public transit" refers only to fixed-route, fixed-schedule buses and trains available to the general public, usually for a fare. (Think of anything from the New York City

Subway to the non-yellow buses that traverse the streets of small cities.) Refer to the Legend of Travel Modes (earlier on p. xi) for a summary of these definitions and the color-coding scheme I maintain throughout the dissertation. (Table 5 includes additional detail).

And third, education policy scholars often discuss and debate school choice. In this dissertation, I divide school choice into two categories: public school choice and private school choice. I define public school choice as any student who attends any public school *other* than the one to which their school district assigned them based on their residential location. This includes charter schools, which are tuition-free public schools still subject to public accountability but authorized for additional autonomy and flexibility; magnet schools, which have specialized programs designed to attract students from broader geographies than a traditional public school; intra-district school choice, which is when a student attends a traditional public school other than the one the district assigned because there was open space; and inter-district choice, which is when a student enrolls in a school outside their home school district because the receiving district has open space and a program for accepting outside students. I define private school choice as any student attending a private school that has a physical campus, is not subject to public accountability, and generally charges tuition (though that may be waived for some students).[1]

1.2. Dissertation Overview

This dissertation proceeds in four parts. In Part I (which includes this introduction), I review the literature on school travel mode choice, school transportation policy, and institutional policy analysis, and in doing so I identify three key gaps in the literature. I also provide an overview of my conceptual frameworks, data, and methods. In Part 2, I analyze school transportation policy and student travel in the U.S. by calculating changes over the last quarter-century, examining variations in state school

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[1] I exclude two types of school choice in this dissertation. First, I do not consider homeschooling or virtual schooling, largely because students in these programs do not travel to/from a school campus. Second, I do not consider public funding of private school choice—commonly known as "vouchers"—because voucher programs are not legal in California and thus are not included in Part 3 of the dissertation.

transportation policies, and applying these state policies to individual student trips to/from school from the 50 states. Part 3 is similar to Part 2; I analyze a sample of California school district transportation policies and programs, and I apply the criteria for those to individual student trips to/from school from across the state. Finally, Part 4 is a discussion of my findings and their implications for school transportation, including for transportation planning and education policy. Ultimately, I find that the school transportation policies I evaluate are strongly associated with access to education.

Part 1: Introduction, Background, and Approach

In addition to this Introduction, Part 1 contextualizes school travel behavior and transportation policy in the United States. I review the literatures on school trip travel mode choice, outcomes linked to school transportation, and the role of institutions in defining transportation and educational opportunity in Chapter 2. I identify three key gaps in the literature: (1) a lack of inventory of state school transportation policies, (2) a gap in our understanding of what explains the variations in these state and local district policies, and (3) the absence of an established link between institutional policies and travel outcomes. In Chapter 3, I explain my conceptual frameworks for both my school trip travel mode analyses and the school transportation policy variation analyses. I follow that with an overview of my data sources, both existing and those I collected and assembled for this research. Finally, I end Part 1 with details about the methods I use to descriptively analyze and model the relationships between school transportation policies and student travel behaviors.

Part 2: U.S. State School Transportation Policies and Travel Behaviors

Part 2 is a national analysis of school transportation policy and student travel in the United States. First, in Chapter 4, I evaluate whether school travel behaviors have changed in the first quarter of the 21st century. This analysis comes on the heels of 30-plus years of transformational change in school travel: the majority of students in 1969 walked or biked to school, but by 2001 roughly half of students drove or were driven, while only 16 percent walked or biked. Despite these dramatic changes from 1969 to 2001, I find little evidence that school travel mode selection has meaningfully changed in the United States from 2001 to 2022.

Might this relative school travel stasis in the 21st century be owed to policy? In Chapter 5, I describe the variations in the 50 states' school transportation policies, and I construct models to explain those variations. I find that state policies vary widely, and that little else explains these variations beyond the policies of neighboring states. Finally, in Chapter 6, I link these policies to students' school travel from the 2017 National Household Travel Survey (NHTS). Model results reveal that state policy was meaningfully associated with school travel mode. A trip that was supported by state policy (either by the state requiring school bus service be provided and/or by the state funding it) was associated with higher odds of school bus use and lower odds of automobile use, all else equal.

Part 3: California School District Transportation Policies and Travel Behaviors

Part 3 repeats the analysis structure in Part 2 but for California. California is an unusual case in school transportation policy. Until 2023, it was one of only two states that did not require districts to transport any students and did not have a formula to direct proportionate funds to districts for providing transportation. For this policy analysis, I collected the transportation policies of a stratified random sample of 119 California school districts. Free of most restrictions that other states typically impose on their districts, in Chapter 7 I find substantial variation in California district school transportation policies, again largely predicted by nearby districts' policies. California districts were more likely to offer transportation service to neighborhood zone school students over public choice program students, and instituted minimum eligibility distance thresholds that increased with student age.

Chapter 8 reveals that, similar to the national analysis, these district policies in California were associated with student travel mode choice. I find that California has a school bus mode share less than a quarter that of the country on the whole—only eight percent in 2017, compared with 35 percent nationally.

Part 4: Synthesis, Policy Implications, and Conclusion

I conclude the dissertation by synthesizing results across the national and California analyses and discussing four policy implications for these findings. First, I recommend that state policymakers adjust school transportation distance eligibility thresholds so that students living outside of *reasonable* walking distance receive state-supported school bus service. Model results suggest this distance is somewhere between 0.5 and one mile, while many states and districts have much longer thresholds than this. Second, I suggest that transportation professionals in both education and transportation should plan with both morning and afternoon trips in mind. My model results both nationally and in California reveal that students rely significantly more on non-automobile travel modes in the afternoons—school bus, walking, public transit, and biking—as parents/caregivers who may have chauffeured their children to school in the morning are at work during the afternoon dismissal. Third, I make a case for states prohibiting districts from charging transportation user fees. Nationally, a state allowing its districts to charge school bus fees had roughly the inverse effect of a state supporting school bus service. Finally, I argue that transportation is a key component of school choice programs, and that such programs should only exist if transportation access to them does too. I conclude with suggested directions for future research, which include evaluating district policies within states that have strong/generous school transportation policies, amounts of state funding for school transportation, and the nuanced role of public transit for school-related trips. I also advocate for the continuation/resumption of travel survey data collection in the United States amid the proliferation of big data options that do not offer the same socio-demographic detail necessary for understanding important population subgroups like children and for ensuring equitable access to opportunities across various socio-demographic groups.

2. Literature Review

There is, appropriately, an entire academic discipline—and parts of several others—dedicated to studying what happens to students once they pass through the schoolhouse doors. But scholars have made relatively very few explorations into how the 55 million U.S. schoolchildren journey to school and, more importantly, what associations there may be between the journey and outcomes at the destination.

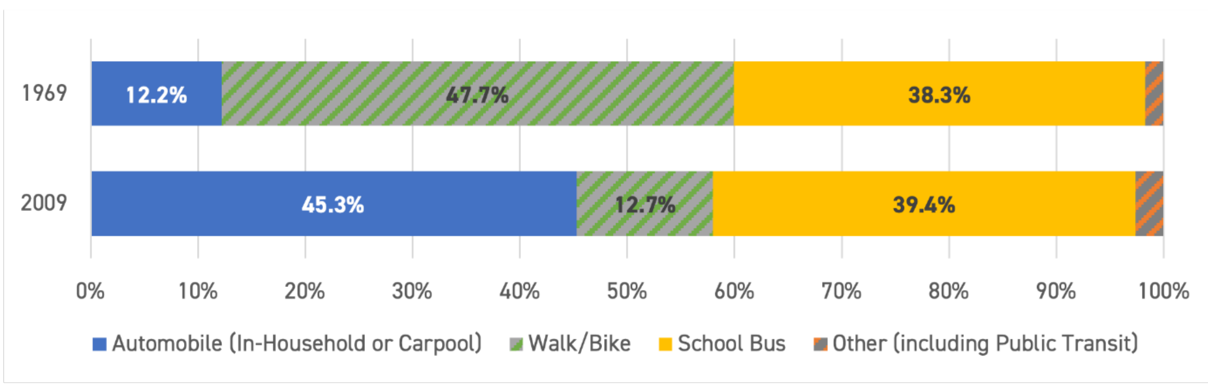
The literature to date at this intersection has primarily clustered around two themes. First, planners have sought to explain travel mode choice for school trips, with much of their attention geared toward promoting active—walking and biking—travel modes. And second, education policy scholars over the past decade have focused on the relationship between transportation and attendance (with some forays into achievement as well). But both have largely been limited by a key missing component to their studies: planners have known little about the travel options available to students and how these vary across households, school districts, and states. These travel options—termed "mode choice" by transportation planners and engineers—are important to understanding school travel, especially regarding the availability of school bus service. Similarly, education policy scholars have generally not had access to data on the travel behaviors of students and rather relied only on their *eligibility* for transportation services.

This literature review details both of these bodies of scholarship. I also review the literature on policy innovation in education, as school transportation policies rest in education statutes and codes. While the focus of this dissertation is travel mode and, especially, the policies that influence students' travel mode choice sets, I include education policy studies here too, because they provide the basis for why studies on this topic matter: that we have reason to believe transportation may be linked to educational outcomes.

2.1. Travel to School Mode Choice

Travel to school in the pre-pandemic United States occurred on five principal modes: private automobile, yellow school bus, walking, bicycling, and public transit. The big difference between the commuting patterns of children ages 5 to 17 going to school as compared with their adult counterparts was the school bus mode: roughly 35 percent of U.S. students ages 5 to 17 rode the school bus to school. Just over half of students nationally were driven or drove themselves to school in 2017; of the remaining 12 percent who did not take a private automobile or school bus, about 10 percent walked or biked and about 2 percent took public transit (FHWA, 2019; Kontou et al., 2020). Over time from 1969 to 2009, the school bus mode share among students in kindergarten through eighth grade has remained relatively steady; however, as illustrated in Figure 1, the share of students who travel by automobile has skyrocketed while the share of those who travel by active modes has plummeted (McDonald et al., 2011).

Figure 1: K–8 U.S. school trip travel mode shares, 1969 and 2009 (McDonald et al., 2011)



As I previously noted, most researchers have been unable to construct the “choice set” for travel modes to school. In most travel behavior studies, the choice set of modes available to a traveler is usually known; most travel surveys ask about the availability of household vehicles and the health of the respondent (for the purposes of identifying the feasibility of walking/biking), and public transit is generally available in most major and minor metropolitan areas in the U.S. Thus, scholars have been reasonably certain about which of the principal modes are available to each person across some combination of automobile, transit, walking, and biking, with other assorted modes (such as ridehail) making up a small fraction of the remainder. However, the school bus complicates this matter for school trips. While the school bus is pervasive in the U.S., it is not *universally* available. Whether or not the school bus is included in a family's school trip mode choice set depends on state and local school district policies, which vary widely (McDonald & Howlett, 2007). As I mentioned in the Chapter 1, this is especially true in California, where the school bus is more often not in the choice set. Researchers have dealt with this issue in a variety of ways I explain in the Conceptual Framework section.

Analyses of school trip mode choice have typically considered three geographic levels – national, state, and local—though the first and third of these are more common than the second. Nationwide studies are common because data are readily available and are updated regularly, in turn offering insights into the changing nature of these trips (Kontou et al., 2020; McDonald et al., 2011). Local studies are also common because studying one or two school districts allows researchers to isolate a policy environment so that families' individual choice sets are better understood (Cordes et al., 2022; Ewing et al., 2004; Schlossberg et al., 2005). Conversely, state analyses are less common because few states have exclusive household travel surveys and the choice sets are complicated to understand (Speroni, 2023). Ultimately, the diverse nature of these studies makes it difficult to create a uniform understanding of the characteristics that are associated with school trip mode choice. Below I summarize the findings of these studies across the three levels of political geography and conclude with some emergent themes.

2.1.1. Nationwide/State Studies

For U.S. national studies, the most common data source is the National Household Travel Survey (NHTS), a semi-regular survey conducted by the Federal Highway Administration (FHWA) that provides a detailed cross-sectional analysis of the travel behaviors of U.S. households on an assigned "travel day." (This is the root data source for two of my three analyses in this dissertation, which I detail in Chapter 3.) Four recent studies looked at student school trip travel mode choice at a national level using these data, two of which explained overall mode choice (Lidbe et al., 2020; McDonald, 2008a) and two of which sought to predict active mode (i.e., walking and/or biking) selection (Kontou et al., 2020; McDonald et al., 2011). I describe these in order of publication.

First, from the 2001 NHTS, McDonald (2008a) used multinomial logistic regression with driving/riding in an automobile as a reference category to argue that because walk travel time to school was the strongest predictor of walking to school, policies that do not address the spatial distribution of homes and schools by bringing those closer together would be unlikely to increase the prevalence of walking to school. She also found significant coefficients on age, having siblings, and gender: Older children and children with siblings were more likely to ride the bus and walk than ride in a car, and girls were less likely to walk than take a car.

In a follow-up study (McDonald et al., 2011), McDonald and coauthors used the 2009 NHTS and added new variables to their analysis, including parent characteristics like education and country of birth, and examined only the probability of walking or biking to school. This time, they used a binomial logistic regression model to predict the odds of walking to school. They found ethnicity (Hispanic/Latino), higher ratios of vehicles to drivers within households, and lower parent educational attainment to be associated with lower odds of the student walking/biking, while they found a student being male, living in a household with a higher income, having a foreign-born parent, and living in an urban area all to be associated with higher odds of walking. Above all, they found trip distance to have the largest marginal effect, with decreasing odds of walking/biking as trip distances increase toward the one-mile maximum they imposed (as their focus was on walking and biking).

Later, using 2017 NHTS data and a similar binary logistic model to predict walking/biking to school, Kontou et al. (2020) found that most mode choice determinants remained similar to past years: students were less likely to walk to school if they lived further away from school or if their parents owned their homes, while students were more likely to walk to school if they were male, older, lived in a zero-vehicle household, came from a wealthier family, or lived in a dense area. Their study also controlled for race/ethnicity, but unlike in 2009, it was notably not a statistically significant predictor of walking/biking (Kontou et al., 2020).

A fourth study, Lidbe et al. (2020), conducted a similar analysis to Kontou et al. (2020); however, their multinomial logistic model used "other modes" as a reference category, which encompasses less than one percent of all travelers and complicates understanding of the more-frequent choices between automobile, school bus, and walking trips. This approach makes it difficult to draw conclusions about and between the five primary modes; the more conventional approach would be to use the choice with the most instances (which in nearly all travel mode choice models in the U.S. is the automobile), which would have allowed for the interpretation to be framed around alternatives to the car (J. S. Long & Freese, 2014).

I am only aware of one state-specific study of student school trip mode choice. Most transportation survey data are either national or local (e.g., a metropolitan planning organization runs their own locally focused survey). The NHTS is expressly not designed to be used for state-level analysis, except in cases where states purchase additional participants so that they can perform such analyses (Westat, 2019). Georgia was one such state in 2017. Using the 2017 NHTS Georgia Add-On, I previously analyzed the mode selection between automobile and school bus for students who were eligible for school bus service (those who lived at least 1.5 miles from their school, which practically excluded walking; other modes had sample sizes that were too small to analyze) (Speroni, 2023). I found that Georgia students were more likely to ride the school bus if they were Black, older, or living in greater Atlanta, while students were more likely to ride in a car (instead of the bus) if they lived further from school, were girls, had a parent with a college degree, or had a parent with a flexible work schedule. This study highlights that several categories—especially race—are much more nuanced and revealing at the state level as compared with studying the nation as a whole, suggesting that different policy and cultural environments across the country may lead to varied travel behaviors among students in different states and regions.

2.1.2. District/Area Studies

Several scholars have modeled school travel mode choice examining different, more specific geographies—and thus different mode choice sets. While national and even state studies broadly cover many school districts that each have unique policies and built environments—which may combine to alter the factors that influence travel mode choice for school trips—local analyses offer more succinct and uniform policies and built environments. However, their generalizability beyond their study geographies is likely limited. Prior studies have drawn on district-level data from California, Florida, North Carolina, and Oregon.

In Southern California, He (2011) used a multinomial logit model to examine personal, environmental, and school factors in predicting mode choice in Southern California. The study considered the odds of walking/biking and using a bus (school or transit) for students in kindergarten through sixth grade and separately for students in grades seven through twelve, using data from the 2001 Post Census Regional Household Travel Survey for the Los Angeles region. Specifically modeling for walk/bike or school bus use, she found that for both grade groups increased distance to school and increased numbers of household vehicles were associated with lower odds of walking/biking to school. Other characteristics were less consistent across the age groups. For example, an increase in age by year was associated with greater odds of walking to school for the younger age group and lower odds for the older age group; this is likely attributable to students' gaining independence as they age through sixth grade but then gaining driver licenses as they age through high school. Additionally, Latino/a students were more likely to walk in both age groups, and increased household income was associated with less bus use for both age groups and less walking among the older group (but not the younger group). He's findings demonstrate that determining the predictors of mode choice vary across combinations of characteristics, depending on how researchers construct their models. Additionally, understanding mode availability was an acknowledged limitation of this study; that is, He did not know if a student had a school bus available to them in their choice set and accordingly mentions the need for examining school busing policies.

Ewing et al. (2004) addressed this issue by examining a single school district in Gainesville, Florida, in which the mode choice set was fully known. Although they theorized that school transportation could better fit into a nested logit structure—one in which families first choose whether to drive and then choose from a subsequent set of modes—they found the regular multinomial logit structure (an even-level choice among all available modes) to be preferable due to the absence of strong evidence of shared unobserved factors among the non-driving modes. They included a wide variety of variables in their models, including built environment, such as jobs-residents balance and density; urban design, such as sidewalks with trees and sidewalk widths; and school data from the Alachua County School District. Notably, they elected not to analyze general public transit as a possible mode, as only four students used it out of a sample of nearly 800 from two travel surveys conducted simultaneously in the Gainesville area by the region's metropolitan planning organization and the Florida Department of Transportation. Ultimately, they found that students with shorter walk and bike times were more likely to walk and bike than ride/drive in a car, while they describe school buses as "a mode of last resort" (Ewing et al., 2004, p. 62). They also found that urban form was significantly related to walking rates; specifically, they found a positive association with sidewalk width.

Other studies also suggest built environment characteristics are related to school travel mode choice. McMillan (2007) generally supported Ewing et al.'s findings in a binomial logit analysis of urban form variables predicting walking/biking using original travel survey data from 16 schools in Northern and Southern California. She included the proportion of street segments with a complete sidewalk system, the proportion of street segments with houses facing the street, and the proportion of a street with mixed land uses. The latter two were positively associated with students walking to school; surprisingly, complete sidewalk systems were not. Along the same lines, Schlossberg et al. (2006) found distance, intersection density, and dead-end street density have increasingly negative effects on students' choice to walk to school.

Not all reasons for parents driving their children to school are associated with urban form and walkability. Several studies examine the relationships between a variety of factors and the choice to drive or walk to school that are better revealed in local data, including parental preferences and school obligations. In a study of only walkable built environment areas in the San Francisco Bay Area, McDonald and Aalborg (2009) surveyed parents/caregivers of middle school students in the Oakland, California area and found that parents were particularly concerned about the presence of strangers ("stranger danger"), the distance to school, and the time their child would spend walking; their respondents also commonly cited the ability to drop off their child on the way to work. Schlossberg et al. (2006) also found heavy backpacks, dangerous traffic conditions, and extracurricular activities as reasons for parents driving their children to school in Bend and Springfield, Oregon. Notably, the Schlossberg et al. (2006) study also identified bad weather as a reason for parents driving, which is less of a concern in the Bay Area (including the respondents in the McDonald and Aalborg (2009) study) and much more of an issue in Oregon. Neighborhood social trust (McDonald, 2007) and household transportation options, attitudes, and social norms may also play a role in this decision (McMillan, 2007).

I find it particularly noteworthy that the existing research literature does not meaningfully touch on fixed-route, fixed-schedule public transit (e.g., Los Angeles Metro buses and trains) as a part of the school trip mode choice decision. This omission does not seem intentional but rather a result of three potential factors. First, public transit use to and from school appears quite rare, especially outside of a few major dense cities (Bierbaum & Vincent, 2013; Kontou et al., 2020; Vincent et al., 2014) (There are studies about public transit use and school in Baltimore, New York City, Philadelphia, and Washington, D.C., but none are mode choice studies.) Second, relatedly, data about school trip mode choice are difficult to find and obtain; most travel surveys ask only limited questions about the school commute, and most school district surveys are confidential and do not ask about transportation, especially outside of school buses that the school district directly provides. And third, many—perhaps even the majority—of school mode choice studies focus on the choice to walk to school; some researchers model only that as an outcome, lumping public transit into a hodgepodge group of motorized modes (which is comprised of mostly private cars and school buses).

2.1.3. Common Themes Across Studies

Both the different combinations of variables scholars have included in their school trip mode choice models and the varied geographic scales of analysis have made comparing studies to each other difficult. Nevertheless, Table 1 synthesizes the statistically-significant relationships across eight models in six key studies. These studies range geographically from national at largest down to single district. They also vary in the ages of students studied, and in the reference choice in the logit model—in most cases, scholars have predicted the odds of walking or biking compared to any other choice, because in theory the option to walk is available to nearly all children, even if it would be an extreme option for students living far from their schools (McDonald, 2008a).

There are a limited number of consistent conclusions across these studies. Regardless of year, population, and geography, longer trips to school—be they measured in terms of miles or minutes—are associated with a lower probability of students walking or biking to school. This is quite logical. Another logical, stable association is the one between living in an urban or dense neighborhood and the likelihood of walking to school; naturally, urban neighborhoods are more likely to have sidewalk infrastructure and planned environments for pedestrians, which makes walking a more attractive option for families. Another pair of commonalities lie in age: students are more likely to walk or bike as they get older, up through the end of middle school in 8th grade; after that point, their likelihood of using any mode other than an automobile drops precipitously as they age into eligibility for driver's licenses.

Table 1: Associations and directions among school travel mode choice studies, 2004–2025

Study	Ewing et al. (2004)		McDonald (2008)	He (2011)		McDonald et al. (2011)	Kontou et al. (2020)	Speroni (2023)
Geographic level	District		National	Region		National	National	State
Geography	Gainesville, FL		U.S.	Southern California		U.S.	U.S.	Georgia
Model Form	MNL		MNL	MNL		BL	BL	BL
Mode Predicted	Walk	School bus	Walk	Walk/bike		Walk/bike	Walk/bike	School bus
Population	Gr. K-12		Age 5-13	Gr. K-6th	Gr. 7-12th	Age 5-14	Age 5-17	Age 5-17
Trip								
Distance				–	–	–	–	–
Duration	–	NS	–					
Time of day (PM)								+
Student								
Age			+	+	–	+	+	+
Sex (Male)			+	NS	+	+	+	+
Race/Ethnicity								
Asian			–	NS	NS			
Black			NS	NS	NS	–	NS	+
Latino			NS	+	+	–	NS	NS
White			Ref	Ref	Ref	Ref	Ref	Ref
Other			–	NS	NS	NS	NS	NS
Siblings			+					NS
Driver License	NS	–						–
Household								
Income	–	NS	NS	NS	–	+ (>$100k)	+	NS
Single-parent								NS
Homeowner						–	–	NS
Foreign-born						+		NS
Parent medical cond.								NS
Parent with bachelors+						+		–
Parent with flex. sched.								–
Parent homemaker						+		
Household vehicles	–		NS	–	–		–	NS
Built environment								
Trip season								NS
Urban cluster or major metro						+		+
Pop. den.	NS	NS	+	NS	+		+	NS
Gas price								NS
Median home value				NS	NS			
Sidewalk coverage	+	NS						
Concerns								
Distance						NS		
Crime						NS		
Weather						–		
Traffic/speed						–		
School Characteristics								
Residential Sch. Quality (API)				NS	NS			
Destination Sch. Quality (API)				NS	NS			
Dist. to nearest elem. sch.				+	NS			
Enrollment size	NS	NS						

+ = Significant, positive association
NS = variable included but not significant
BL = Binary logistic regression

– = Significant, negative association
[grey box] = variable not included in model
MNL = Multinomial logistic regression

Some other factors vary across studies. In particular, income and race/ethnicity are astonishingly inconsistent. Nationally, higher incomes are associated with higher probabilities of walking/biking, yet in both Southern California and in a Florida school district, income is negatively associated with walking. The only consistency among studies that include race/ethnicity is the use of white students as the reference group; more often than not, race is not a statistically significant predictor of students' travel mode in multivariate models with other variables held constant.

Most other variables shown in Table 1 appear only in one or two studies. Differences across these studies are often a function of available data or different theoretical framings of the studies. For example, McDonald et al. (2011) pays special attention to four possible concerns of parents for allowing their children to walk/bike, because the 2009 NHTS offered those data in a special module. Similarly, He (2011) focused on school quality and characteristics because she had unusual access to those data.

2.2. Why School Trip Travel Mode Matters

Why do students' travel mode choices matter? I identify four themes across the prior scholarship. First, studies suggest that travel mode—or at least the availability of some travel modes—may affect school attendance. Second, a small pool of studies suggests that travel mode, specifically access to a household vehicle and/or a school bus, is associated with students choosing to attend public schools other than the one to which their home school district assigned them. Third, student travel mode is associated with trip duration, which has downstream effects on how students spend their time. And fourth, school travel is a massive undertaking each weekday morning for most of the year and, in turn, has effects on the broader transportation system. Undoubtedly, a fifth theme could be the relationship between walking and biking (what planners refer to as "active travel") to school and physical health; however, no studies to date have tied travel mode to school *directly* with health. Rather, these studies have determined that increased physical activity in general is beneficial to students, but this increase in activity could be achieved in myriad ways other than walking or biking to school. Thus, I exclude that literature here, for now.

2.2.1. School Attendance

The single most important reason for studying travel to and from school is that it enables students to attend school in the first place. Nonetheless, few studies have explored this relationship between student transportation and student attendance. That is likely due to the interdisciplinary nature of the operation and not due to its importance. As Lenhoff et al. (2022) admit, "Educational policy and politics have been dominated by school improvement initiatives that locate educational problems and solutions in schools themselves, rather than in the systemic and structural roots of those problems" (p. 1). Those authors advocate for considering education policy as an ecosystem, rooted in Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1976), rather than simply as a school system. Transportation is an integral part of that ecosystem.

A recent small body of literature has emerged to suggest that transportation plays a meaningful role in students' attendance rates, especially related to chronic absenteeism. This began with Gottfried (2017), which found that kindergarten students in the U.S. who used a school bus were less likely to be chronically absent than students who used private or active modes of transport. Subsequent studies had similar findings. Stein and Grigg (2019) found that more complex and/or longer public transit trips were associated with a small number of additional student absences in Baltimore. Blagg et al. (2018) found similar results for student drive durations in Washington, D.C. However, the latter two studies assume that all students travel by the same mode—public transit and riding in cars, respectively—which is an overgeneralization. Subsequent studies addressed this in part by examining students' eligibility for school-supported transportation. In Michigan, being eligible for school bus service was associated with better attendance outcomes for economically disadvantaged students (Edwards, 2022). But in Detroit, scholars found that transportation eligibility had a small but significant negative association with attendance (Pogodzinski et al., 2021). Why the disconnect? Pogodzinski et al. (2021) suspect that it may be due to lacking data on the actual *use* of school bus transportation, as eligibility data only identify students who *could* use transportation rather than those who use it regularly.

2.2.2. School Choice

Another important role for transportation in education is its ability to facilitate school choice. School choice is the process of allowing families to choose the K-12 educational options that best fit the needs of their children. In the U.S., debates about school choice typically refer to public school choice—mostly magnet programs and charter schools. Magnets are schools with specialized programs designed to attract students, while charter schools are schools that receive public funds and are publicly accountable but operate outside the traditional state and/or district structure.[2] Proponents of school choice contend that school choice provides alternatives to traditional public schools for children who have poor educational options in their neighborhoods and/or for children with other needs and/or interests. In contrast, critics argue that public funds to support choice schools undermine the traditional public school system (Berends, 2015), which educates the majority of America's children. Regardless of the debate, the number and percentage of children attending public school choice programs in the past 30 years has steadily risen.

But school choice only works if students have transportation to attend these choice schools. Studies generally find that students attending choice schools travel greater distances than they would otherwise (Speroni et al., 2026; Yang et al., 2012), largely because higher-performing schools are located in just a few neighborhoods, most of which are wealthier and whiter (Corcoran, 2018; Edwards & Cowen, 2021; Gross & Denice, 2017). Despite these longer distances that likely preclude walking to school for many students, many states do not require school districts to provide school bus service to choice school students at the same level as traditional public school students (Bierbaum et al., 2020; McShane & Shaw, 2020), and the longer distances from students' homes to choice schools often make public transit impractical (Chingos et al., 2017).

[2] A third form of public-school choice is the private school voucher, which allows families to use public funds to partially or fully pay for private schools. Because these vouchers are not legal in California and because I am unable to determine choice program students in national data, I do not address them here.

A small number of studies have explored the relationship between student travel mode, transportation resources, and school choice. In New York City, one study linked student enrollment records to enrollment in school bus and public transit pass programs. The authors found that students enrolled in choice schools were more likely to sign-up for these school-sponsored transportation programs, and that among choice school students, transportation program users were more likely to have enrolled in a high-quality school (Cordes & Schwartz, 2018). But New York City's transportation environment is atypical in the United States; while transit and walking dominate in New York, most Americans rely on the automobile for daily transportation—including school travel. Three other studies consider the role of the car in school choice. In Detroit, a city where most students attend choice schools, two studies found that living in a neighborhood with a low percentage of automobile ownership was associated with a higher likelihood of attending a neighborhood zone school rather than a choice school (Edwards, 2021; Singer & Lenhoff, 2024). And in California, my co-authors and I found—using the same core dataset as Chapter 8 of this dissertation—that a student from a household with at least one automobile had a predicted probability of attending a public choice school of 33 percent, but for a student from a household without a car, that probability dropped to just 13 percent (Speroni et al., 2026).

2.2.3. Student Time Use and Time Constraints

Transportation has been linked to other student outcomes, particularly around time use. Spence (2000) highlighted early anecdotal research suggesting that long journeys to school negatively affect students' lives, particularly by absorbing time that could be spent in other ways that are healthier and more productive. Voulgaris et al. (2019) later quantified this. They used the American Time Use Survey to find that students who spent more time traveling to and from school in turn spent less time on critical health-promoting activities like sleeping and exercising. For every 10 minutes of additional school commute duration, they predicted a 13-minute reduction in sleep; they found a similar relationship with school commute duration and minutes spent on exercise. In all likelihood, the situation is only amplified for our most vulnerable students. Previously, I demonstrated that children experiencing homelessness and foster youth had substantially longer commutes to school than their less-vulnerable peers—especially so if school and county officials did not provide them with specialized ridehail transportation (Speroni, 2020). This logic could also extend to rural students and students in school choice programs, both of whom tend to have longer commutes to school by both distance and duration, but there are caveats to both. First, the difference between urban and rural travel is generally larger by distance than duration, because rural travel is largely automobile travel at high speeds, while urban travel is multi-modal (with most other modes slower than the automobile) and can experience slower speeds due to congestion. Second, it is possible that longer school commutes for choice school students may still ultimately be a net gain, because those schools' specialized or different programs may benefit students more than the costs that their longer commutes impose.

An additional nuance to the literature I first explored in my Georgia analysis was disaggregating trip time of day by morning to-school trips and afternoon from-school trips. Bus-eligible students were significantly more likely to arrive at school in family automobiles in the morning and significantly more likely to use the school bus in the afternoons (Speroni, 2023). This finding is likely a function of schedule overlaps: most U.S. school days begin by 8:30 AM (National Center for Education Statistics, 2020) and most U.S. workdays begin by 9:00 AM, but schools typically dismiss well before the traditional workday ends at 5:00 PM. As a result, many parents/caregivers have work schedule flexibility in the morning to chauffeur kids to school before work but lack that same ability in the afternoon. This flexibility may have changed in today's era of hybrid work, though many may still choose to rely on other means of transportation for their child in the afternoon.

2.2.4. Effect on the Transportation System

To the overall transportation system, school travel is (quietly) a big deal. One study estimated that 14 percent of all private vehicles on the road during peak morning commute times during the school year in the U.S. are carrying children to school, and these vehicles account for five to seven percent of the vehicle miles traveled (VMT) during the morning peak period (McDonald et al., 2011)—in other words, these are relatively short trips, but there are lots of them. These numbers are very likely higher in states with lower shares of school bus use and higher shares of private vehicle use for school trips, like in California. Because transportation planning is largely (albeit not mostly) an exercise in managing peak period, peak direction travel, understanding student travel mode choice—and how it may be possible to shift students out of cars, or more students into fewer cars in carpools—can help reduce strain on existing infrastructure and limit the need for expansion.

Although transportation planners have traditionally considered only the morning peak to be affected by school travel, there is some evidence to suggest that a shifting afternoon peak also feels the effects of school travel. Using late-pandemic data for Southern California, colleagues and I found that the afternoon peak travel hour in Southern California had moved up from 5 PM in 2019 to 3 PM in 2021, and that the presence of schoolchildren in a neighborhood was overwhelmingly the largest predictor of an earlier afternoon peak (Speroni et al., 2024). School chauffeuring may also be likely—more likely than even in-person *work*—to bring people out of their homes during the peak periods (Lachapelle et al., 2018). In short, not only does school travel add vehicles to both peak periods; the overall peak afternoon period may also be moving up to coincide with a time of day long dominated by school trips.

Might these changes lead to increased traffic congestion? One study suggests yes. Rick (2023) exploited the variation in the number of school travel days per month across different primary-city school districts in the 51 largest urban areas in the United States (such as the Los Angeles Unified School District for the Los Angeles urban area). He found the pre-pandemic effect of a complete school month increased total congestion by 18 percent, and that the effect was strongest in the morning peak, when school trips increased congestion by 25 percent. Rick also found evidence that school transportation programs, which enable students to take more road space-efficient modes like school or public buses to school, very likely reduce congestion. A 10-percent increase in the percentage of students transported to school by school bus was associated with a 2.3-percent reduction in congestion overall, with a 4.5-percent reduction in the AM peak period. More generally, a 10-percent increase in per-student transportation spending (which is typically for school bus service or but can also be for subsidized public transit) was associated with a 0.9-percent decrease in overall congestion and a 1.1-percent decrease in AM peak period congestion. For cities like Los Angeles and San Francisco that currently have both comparatively high congestion and low transportation spending per pupil, public investment in school transportation—especially school buses—could prove an especially cost-effective way to reduce congestion.

2.3. The Role of Institutions in Determining Travel Options

While planning scholarship has addressed many reasons behind school travel mode choice, a common missing piece in these studies is the choice set. In other words, while scholars have modeled why children or their parents/caregivers choose to drive or be driven, take the school bus, walk, bike, or take public transit, there has been little research on which of these various modes are available to students, and why. This gap in the literature is especially glaring for school buses. To my knowledge, there have been only two academic journal articles that address this issue: one that explores variations in case studies of state school transportation policy (McDonald & Howlett, 2007), and one that exploits eligibility distance thresholds to examine possible relationships between transportation eligibility and academic outcomes (Edwards, 2022).

Although other forms of transportation—including fixed-route, fixed-schedule public transit (e.g., Los Angeles Metro buses and trains)—generally fall under the purviews of transportation departments at various levels of government, school bus service and the policies that govern it lie almost entirely with educators. But little is known about these policies, including how they vary across and within states and school districts. Accordingly, I review in this section the literature on policy change and institutional interactions to contextualize school transportation policies as part of the broader education policy arena.

2.3.1. Premise: Educational Duty

The premise behind studying school transportation policy is that institutions shape opportunity. In this case, school trip travel mode options for students and families are shaped, at least in part, by the policies of the states and school districts in which the students live. But why do educational institutions set policies and provide transportation for students in the first place? I suggest two reasons.

First, states have a duty to educate children. Through our federal system, states are generally responsible for education, as it is not addressed in the U.S. constitution. Every state constitution "imposes specific affirmative obligations" to educate the state's children (Bauries, 2013, p. 706), and education is compulsory in all 50 states (Diffey & Steffes, 2017). Some states go so far as to enshrine education as a fundamental right (Biegel et al., 2019). But despite this requirement to attend school—which for the vast majority of students means being physically present at school—in 1988, the U.S. Supreme Court ruled that states and districts are not legally required to provide transportation for students to travel to and from school (*Kadrmas v. Dickinson Public Schools*, 1988). In *Kadrmas*, the court held that a North Dakota law allowing districts to charge school bus user fees did not violate the Equal Protection Clause of the U.S Constitution because education and school transportation are not fundamental rights. Still, most states and districts have long operated as though transportation is a key piece of their educational duty (Berger, 1979; McDonald & Howlett, 2007).

Second, modern schooling is predicated on the ability to transport children distances longer than are walkable to and from school. Early 20th century schooling, particularly in rural areas, largely took the form of one room schoolhouses, in which educators taught students across many grade levels in the same room by the same teacher. This format was rooted in the natural limitation of students having only walking as an option for school transportation. The school consolidation movement, which sought to bring economies of scope and scale to primary and secondary education by transitioning away from one-room schoolhouses in favor of larger schools that separated students into different classrooms by grade level, began during the first two decades of the 20th century and took firm hold as sound *and* practical education policy with the advent of motor buses. School buses enabled the transportation of students from up to 20 miles away, a dramatic expansion from the then-standard limit of three miles for students walking to school (Berger, 1979).[3] Despite the added distance, the ease with which students could now travel via school buses led to improved student outcomes; the U.S. Bureau of Education (then under the umbrella of the Department of the Interior) published a comparative study that found students who received school bus transportation in the late 1920s had better attendance on average than those who did not (Gaummitz, 1930). Coupled with the accepted notion that consolidated schools were superior to one-room schoolhouses, transportation became "one of the most important duties of the board of education in a large school district" (Berger, 1979, p. 155). By 1928, at least some districts in every U.S. state offered school bus service to students at public expense (Johns, 1928).[4]

2.3.2. Policies Vary Across and Within Governments

Although all states did—and do—have school transportation legislation, the limited prior scholarship suggests that today the policies in those legislative statutes vary—and perhaps widely—from state-to-state (McDonald & Howlett, 2007), and from district-to-district within given state policy environments (Edwards, 2022). While there is not yet a systematic evaluation of state policy variation for school transportation, states lead policymaking in several key arenas, including education, healthcare, and transportation. These efforts can be instructive in establishing a conceptual framework for studying school transportation policies. How and why do governmental policies vary across other governments of the same level? Here I synthesize the literature largely focused on state policy variation, but much of it can be applied to local school districts, too. Local school districts are political subordinates of their states, and their powers are only those granted by state legislatures (Hanson, 2008; Wong, 2008).

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[3] Education officials in the 1920s saw a maximum home-to-school distance of 15 to 20 miles as a time-limit proposition, with school buses limited by the era's rudimentary quality of rural roads.

[4] Roe L. Johns, the first president of the Association for Education Finance and Policy (AEFP), wrote his 1928 dissertation on this topic, titled "State and Local Administration of School Transportation."

Policies vary state-to-state across a variety of dimensions. Citizens and public officials alike in each state understand their circumstances and problems differently, leading their policy decisions to differ as well (Saiz & Clarke, 2008). There are several theories to explain policy change that scholars have identified and used to analyze such changes in education (McLendon et al., 2014), including:

- **Multiple-Streams Framework (Revised Garbage Can),** largely drawn from the work of Kingdon (2003), which suggests that policy change is the product of agenda setting.
- **Punctuated Equilibrium**, which posits that most policy is gridlocked except for in moments of extreme change.
- **Policy Innovation and Diffusion**, which balances internal determinants (meaning that states figure out policy themselves through professional legislatures, educated citizens, and electoral competition) with interstate diffusion (wherein states emulate the behaviors of their neighbors/peers).

Most studies of policy design employ a combination of these theories, often through event history analysis methods and considering a variety of state/local population, socio-demographic, place, economic, and political characteristics (Gray, 2008; McLendon et al., 2014).

Education policy—of which school transportation is a subset—is more resistant to change than other public sector institutions (Biegel et al., 2019). Many people, teachers, parents, and pupils among them, need to be informed of changes well in advance, and many levels of bureaucracy are implicated in substantive change. In education, power is fragmented within state governments and varies from state to state. Nongovernmental actors—including labor unions, charter school organizations, and the tax-paying public—have substantial say in education policy as well (Wong, 2008). But ultimately, state governments are an important force, such that the "study of education finance policy is the study of state legislative activity" (Crampton, 2007, p. 470). Scholars have collected and analyzed data about state education policy variation around topics such as free and compulsory school requirements (Aragon, 2015); testing requirements, teacher certification, beginning teacher support programs, pre-charter school choice policies, and school day length (Coley & Goertz, 1990); early learning standards (Scott-Little et al., 2007); developmental education policy (Hodges et al., 2020); and teacher recruitment programs (Garcia, 2024). Often, these studies focus on multiple dimensions of a policy. For example, Garcia (2024) investigated definitions, variations, funding, program/design strategy, and specific commonalities across state teacher recruitment policies.

These studies are often quite descriptive in character, typically including an inventory of state policies in tables and citations to the relevant state statutes and administrative codes. Authors use these tables to organize key policy dimensions and draw conclusions about policy frameworks. In the days before the digital availability of state statutes and widespread Internet use, these types of studies served as important benchmarks for aggregating and disseminating the various policy mechanisms at work across the country, enabling readers to have access to the information without having to seek out physical books of individual state statutes or internal bureaucratic documents (Blank & Espenshade, 1988; Coley & Goertz, 1990). Today, many such policies are readily available on state websites and tracked continuously in the robust National Conference of State Legislatures' (NCSL) Legislation Databases. However, NCSL did not begin tracking school transportation legislation until 2024. For issues without robust tracking, Kelchen et al. (2019) offer a methodology for inventorying policies on one's own, including aligning policies with school year dates (September through June), developing a consistent range of terms to search, using multiple search engines and types to identify relevant statutes and policies, and using the Internet Archive to search for dated policies.

Most studies of state policy variation are event history analyses that gather policy data over several repeated time cross-sections (almost always years) or are tracked longitudinally (Wong & Langevin, 2007), though some studies cover only a single year around a single issue (Barrilleaux & Rainey, 2014). These analyses most often take the form of logistic regression models and, occasionally, complementary log-log models. The models predict the probability of a state enacting a given policy, controlling for the year and other relevant factors. For non-parametric approaches, some studies use cluster analyses. For example, Hendren and Niemeier (2008) identify 10 clusters of "peer states" for general (not school-related) transportation policies. Others, particularly early studies in a field (like McDonald and Howlett (2007) for school transportation) conduct a handful of state case studies with different policy types. And still others rely on formal survey sampling methods; that is, researchers send surveys to state officials in each state to respond to questions about their policies (Poister, 1997).[5]

2.3.3. Interjurisdictional Interactions

A common thread across these studies is that state officials often interact with one another in arriving at their state's policies because, for issues like education, there is not one national superseding policy but rather 50 largely independent state systems. This is the federal system of the United States at work—a division of power between national, state, and local governments creating many different democracies that can each experiment with policies to find those that work best (Hanson, 2008; Wong, 2008). The Theory of Policy Innovation and Diffusion explains how these policies develop and spread amid a decentralized political environment (McLendon et al., 2014). In general, state officials look to each other because, in many instances, they lack sufficient information and are "muddling through" (Karch, 2022, p. 182) until they perceive having enough information—from the federal government, neighboring states, or local governments—to act. This is when new policy becomes part of an agenda, according to the Multiple-Streams Framework (McLendon et al., 2014). As Hanson (2008) describes, states are "at the center of an elaborate web of intergovernmental relations" (p. 31).

Governments (including school boards and school districts) are susceptible—even more than private sector and non-profit organizations—to institutional isomorphism, which is the process by which

[5] There are two potential flaws to this approach. First, and perhaps most obvious, is that getting a full 50-state census requires a 100 percent survey response rate. This is highly unlikely. Poister (1997) received only 32 completed surveys of the 50, although admittedly the study was conducted in the age when Internet access to policies was much less readily available than it is today. Second, there is the issue of interpretability, which I explain more later in this section. In short, the responses of bureaucrats or legislative staff (who are presumably filling out surveys on behalf of their bosses) rely on those respondents' interpretations and operationalizations of state policies, rather than on the consistent interpretation of the same team of researchers across all policies.

organizations become more similar over time (Frumkin & Galaskiewicz, 2004). This happens through mimetic, normative, and coercive pressures. In other words, governments may tend to imitate each other (especially in times of fiscal uncertainty), may feel social pressure to conform to trends (especially from political allies), and may feel threats to evolve or conform to trends (especially from constituents). Interjurisdictional competition helps explain policy innovation and diffusion, but identifying it is difficult, especially when it is not spatial (Karch, 2022).

Governments can relate to one another vertically—as in federal to state—or horizontally—as in state to state. Several studies consider the characteristics I list above—state/local population, socio-demographic, place, economic, and political—in examining these relationships. Some combination of socio-demographics and political control have been associated with varied state use of federal dollars for Medicaid (Kousser, 2002) and variations in state Medicaid expansion policies (Barrilleaux & Rainey, 2014). College financial aid program adoption has been associated with policy diffusion to peer states (Cohen-Vogel & Ingle, 2007) and, as I detail more below, so too has charter school policy enactment. There is also evidence that (perhaps logically, or perhaps not) elected officials and bureaucrats respond to the opinions of their constituents. Pacheco (2012) terms this the Social Contagion Model. Under traditional notions of policy diffusion, State A adopts a policy, and in response, neighboring State B's officials decide to enact a similar policy. In the Social Contagion Model, the citizens of State B learn of State A's new policy, and their opinions on the matter gather momentum—they lobby their state officials to change policy to match State A.[6]

In education policy, scholars have applied these principles and methods to studying the adoption of charter school enabling legislation. Wong and Shen (2002) investigated the role of state political dynamics and other potential influencing factors in examining how charter school legislation proliferated

[6] Pacheco's (2012) classic example of this type of policy diffusion is the spread in popularity of smoking bans in restaurants in the 1990s and 2000s.

through the U.S. in the 1990s. They found that states were more likely to adopt charter school legislation sooner if:

- The governor was a Republican.
- It was an off-year for major elections (gubernatorial or presidential).
- The state had lower-performing schools.
- The state had more private schools.
- The state had neighboring states that had already adopted charter school legislation.

They also found that larger population states and wealthier states were more likely to adopt charter school legislation that included programs targeting disadvantaged populations as a form of opportunity redistribution. This study built on prior scholarship from Mintrom and Vergari (1998) that found evidence of policy innovation diffusion by inventorying state charter school policies by the year they were enacted and through qualitative investigations with state school officials into why they considered charter school legislation. Further investigation found that states had the mimetic tendency to adopt policies similar to those of neighboring states, but interestingly, the researchers also controlled for regional differences and found them to be not significant (Renzulli & Roscigno, 2005). This study also controlled for the percent of non-white students (positively associated with charter school legislation adoption), urban population, state median income, and population size (all three not significant).

Local governments are often fiscally dependent on states, especially in education (Hanson, 2008). States have bigger fiscal capacity than districts because they tend to have broader revenue bases, and accordingly, states have increased support for education more than localities over time (Wong, 1999). This support is constrained by local pressures and desires for autonomy. Nevertheless, states generally hold power in two ways. First, states can condition aid categorically; for example, offering funds to school districts for transportation on the condition that those funds be used *only* for transporting students. Put another way, "Aid is the carrot used by state officials to influence local decision-making" (Hanson, 2008,

p. 55). Second, because local school boards are subordinates to the state (Wong, 2008), states can preempt local ordinances. One way states do this—especially when times are financially tough—is through unfunded mandates, where states require localities to perform delegated responsibilities without increasing state funding to meet the mandate (Hanson, 2008).

Whether districts perform these duties as the states prescribe is a different story. Local implementation of state and other broader policies is difficult (Spillane et al., 2002). As Biegel et al. (2019) explain (and as mentioned earlier), policy change in education—in this case at the state level, for example—means that many people at the state, county, district, and school levels need to be informed, and many levels of bureaucracy (for example, departments within a school district) are implicated. The ultimate implementers of new policy are not always compliant, and in some ways "co-construct" interpretations of new policy messages (Coburn, 2001). This is particularly true when states do not set or set only minimal policy around a given issue. For example, when most states did not have policies around student school readiness (i.e., the standards schools expect of entering kindergarteners), researchers found that districts often made decisions that varied widely within the same state about how to assess children and how to use those data (Saluja et al., 2000).

2.3.4. The Relationship Between Policy and Outcomes

The goal of policy in most cases is to positively affect desired outcomes. To explain how institutional policies develop and how they affect outcomes downstream, Ostrom (2009) developed the Institutional Analysis and Development (IAD) Framework. The IAD conceptualizes policymaking as a system in which rules established by institutions shape the incentives and opportunities facing actors, whose interactions subsequently generate measurable social outcomes. This framework is particularly useful in situations where decisions are constrained by institutional rules in polycentric governance structures (Ostrom, 2010), such as school districts within state policy regimes or individual families within school district rules. A central premise of this framework is that policy does not directly influence behavior; rather, it shapes the opportunity set under which actors make choices.

Although scholars have applied the IAD most widely in public policy, economics, and environmental science, some studies have applied it in transportation and education. For example, Lee et al. (2024) use the IAD to first explain imbalances between transportation and spatial planning due to ambiguous institutional responsibilities, which, in turn, contextualize their evaluation of accessibility outcomes for large transportation infrastructure projects in Seoul, South Korea. Other scholars have applied the framework to childcare outcomes (Bushouse, 2011) and water governance (Hegger et al., 2020). Ultimately, the core concept of this framework is that institutional policies affect opportunities, which in turn affect outcomes.

2.3.5. School Transportation Policy as a Multi-Level System

How does school transportation fit into this mix? Based on the limited literature, school transportation is a multi-level system. The federal government has a very limited policy role, the states have the overarching policy role, and districts are ultimately responsible in most cases for program implementation and delivery. Early studies (Abel, 1923; Johns, 1928) and histories (Berger, 1979; California Department of Education, 2021) indicate that the initial establishment of school transportation policies may be explained by the Theory of Punctuated Equilibrium, with extreme change in school transportation policy brought on by the school consolidation movement and the relatively sudden possibility of automobility. There have been two other waves of change: one with the school racial desegregation movement of the 1970s and 1980s (Delmont, 2016; Godwin et al., 2006), and another with the advent of charter schools in the 1990s and 2000s (McShane & Shaw, 2020).[7]

Federal laws require that three groups of students be transported to and from school regardless of state or district policy: students with disabilities, students who are experiencing homelessness, and students in foster care. For all three of these groups, laws protect and ensure vulnerable students' legal access to a "free and appropriate public education," which is the legal right for every eligible child with a disability to receive special education and "related services," at no cost to the family, that provide the least restrictive environment for their education (Biegel et al., 2019). Transportation is a "related service" (Education for All Handicapped Children Act, 1975). The details of those policies are:

- **Students with Disabilities (Ross et al., 2020):** According to the Education for All Handicapped Children Act (EHA) of 1975, students with disabilities who have an individualized education program (IEP) can have transportation included in their plan if the IEP team of teachers and support staff determines it is necessary in providing a "free

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[7] Although the use of school buses for school desegregation is outside the scope of this dissertation, it is of course important, and I believe it is important that I explain my choice to not include it here. Prior to the passing of *Brown v. Board of Education* (1954), which held that racially-segregated schooling was illegal, school buses were generally "among the educational privileges enjoyed by white students" (p. 2) and not Black students, as explained by Historian Matthew Delmont in his book *Why Busing Failed* (2016), which traces the complex history of busing for desegregation with a focus on the Black perspective. Before desegregation, white parents rarely objected to buses. But *buses* are not "busing." Opposing "busing"—Delmont puts the word in quotes for every single non-quoted use—was a coded way to describe opposition to desegregation, that "white opposition to 'busing' was simply a new way of expressing anti-Black racism, that 'busing' was a phony issue which obscured the causes of educational inequality" (Delmont, 2016, p. 171). The Black community developed an aphorism: "It's not the bus; it's us" (Delmont, 2016, p. 172). Put another way by Georgia state legislator Julian Bond in 1972: "What people who oppose busing object to, is not the little yellow school buses, but rather to the little black bodies that are on the bus" (Delmont, 2016, p. 168).

In the early 1970s districts around the U.S. were placed under court orders for desegregation stemming from *Brown*, the 1964 Civil Rights Act, and *Swann vs. Charlotte-Mecklenburg Board of Education* (1971), which upheld the use of busing as a legitimate means of racially integrating public schools (Gaillard, 2006). But these programs began to roll back beginning with the 1974 U.S. Supreme Court ruling in *Milliken v. Bradley*, which blocked a proposed regional desegregation plan in Detroit that would have involved both the city school district and the surrounding suburbs. *Milliken* limited the application of cross-district desegregation only to districts that had engaged in *de jure* segregation. From there, many regions saw investment in new schools turn to the suburbs and away from cities (Delmont, 2016). This shift has partly contributed to the resegregation of schools. The Supreme Court overturned *Swann* in 1999 with *Capacchione v. Charlotte-Mecklenburg Schools*, which ended court-ordered desegregation (Godwin et al., 2006).[7] Like many districts, Charlotte complied by creating an extensive program of magnet schools to replace court-ordered desegregation plans. But as I argue is true in all forms of school choice, Godwin et al. (2006) suggest that transportation barriers limit families' abilities to choose.

Today, although *de jure* segregation is legally prohibited, schools across the U.S. have *de facto* resegregated along racial lines in large numbers through other means like residential selection, segregated neighborhoods, gerrymandered school attendance zones, and white families exiting neighborhood public schools for choice schools (Frankenberg et al., 2023; Reardon et al., 2019).

and adequate public education" for that student. Even if a state does not require districts to provide student transportation—and even if the district does not otherwise offer student transportation services—districts must provide transportation if it is in the student's IEP. These rights were reaffirmed in the 1990 Individuals with Disabilities Education Act (IDEA) (National Association of State Directors of Special Education, 1990) and have been reaffirmed several times since.

- **Students Experiencing Homelessness (Carlson et al., 2006):** Federal law requires districts to provide transportation to students without a permanent address (ranging from unhoused to students temporarily living in hotels or with a relative) through the McKinney-Vento Act of 1987. This law also requires that districts provide transportation such that students experiencing homelessness can remain at the same school throughout a given school year, even if their residence changes and/or becomes permanent. The goal of this requirement is to minimize disruption and offer consistency to students.
- **Foster Youth** (Pawlowski, 2014; Speroni, 2020)**:** Foster youth gained the same federal school transportation requirements as students experiencing homelessness as part of the Every Student Succeeds Act (ESSA) of 2015.

Providing these specialized transportation services can be costly to districts (Graham et al., 2014), but these groups constitute only a moderate portion of the school-aged population: approximately 15 percent of students have disabilities and receive IDEA-supported services (National Center for Education Statistics, 2024b), about three percent of students experience homelessness as defined by the McKinney-Vento Act (U.S. Department of Education, 2023), and less than one percent of students are foster youth (U.S. Department of Education, 2025). Beyond this group, the federal government expressly makes no guarantees about transportation to and from school.

Where federal policy or guidance is lacking, states have top-level control of policy, and in particular school transportation policy. McDonald and Howlett (2007) conducted six case studies of state policies and developed the following framework for analyzing them:

1. Does the state mandate that districts provide student transportation?
2. Does the state reimburse districts for providing student transportation?
3. What are the eligibility requirements for students to receive transportation and/or for the districts to receive reimbursement of costs for doing so from the state?

The authors concluded that policies among their case study states varied widely, from stringent requirements and substantial state-to-district reimbursement in New York and Ohio to nearly no requirements or reimbursement in California.

Districts are ultimately responsible for implementing transportation programs under state guidelines (McDonald & Howlett, 2007). Local school districts are generally responsible for acquiring a bus fleet (sometimes with state financial assistance), hiring and training drivers, and determining bus stops, routes, and schedules. They can accomplish this either in-house by performing these functions directly, or by contracting with a private firm to handle parts of or all those responsibilities (Burgoyne-Allen & O'Neal Schiess, 2017). While there is evidence of districts inconsistently implementing state policies in other areas of education, there is little recent systematic evidence that districts do not implement transportation policies consistently or faithfully—likely because transportation implementation and the eligibility for it has been the main focus of most litigation on this topic (Page, 2013). Most such lawsuits involved families petitioning the court claiming that their student should be eligible for transportation by some method of measuring home-to-school distance other than the one the school district used to determine ineligibility. Several cases highlight these differences in opinion, which can range from whether a family's front yard counts as distance to school (*Thompson v. Findley Township School Directors,* 1947) to what to do about counting an impassable road (*Gandt v. Joint School District*, 1958). In a 1964 Mississippi Supreme Court case about whether home-to-school distance should be measured from the child's front door or driveway, the court wrote, "The question is somewhat reminiscent of the question which confounded medieval theologians of how many angels could dance on the point of a needle, and borders on the ridiculous" (*Madison County Board of Education v. Grantham*, 1964). Although these cases are quite old, they set precedent that school districts cannot selectively or inadvertently evade their own or state policies.

Ultimately, these policies—both specific to school transportation and more broadly across education and other policy arenas—are decisions about institutional control and resources. Should these decisions be made at the state or local level? States have played a greater role in education funding and governance compared to local districts over the past four decades (National Center for Education Statistics, 2021; Wong, 2008), overriding the longtime presumption that schooling was principally a local enterprise (Timar & Roza, 2010). But instead of debating which level of governance should have control over policy and resource allocation, Timar and Roza (2010) advocate that we instead ask: "What obstacles prevent better connections between real dollars and valuable resources for students?" (p. 399).

2.4. Gaps in the Literature

This literature review reveals three key gaps in understanding school transportation policy and student travel behavior. First, there is little systematic information on school transportation policies. There is no inventory of state school transportation policy characteristics, nor a comparative assessment of those policies. Second, scholars have yet to comparatively evaluate district school transportation program policies and implementation. And third, scholars have yet to establish a link between these policies at either the state or local level and the downstream travel behaviors of students on their school trips. Several studies have attended to the determinants of school trip travel mode choice, but none to my knowledge have yet considered how policies about school bus eligibility, funding, and user fees shape those decisions. Existing studies implicitly treat the school transportation policy environment as constant across children and trips, rather than accounting for variation in school bus eligibility, funding, and fees to which students are exposed—though some studies acknowledge the absence of this information as a limitation (S. He, 2011; McDonald, 2008b).

Part of the reason so many studies have focused on walking and biking may be normative; planners have paid much attention to and long advocated for active travel modes (Pang et al., 2017; Roaf et al., 2024; Winters et al., 2017). But another reason might be that when estimating models for school travel mode, walking is the only choice in the set reliably available to everyone who can walk. While these estimations are not perfect—for example, whether a school bus would be an option for a student who lives 1.1 miles from school would undoubtedly be part of a family's consideration, even if not used—they do at least comprise a full choice set: walk or not walk.

Finally, there are two additional gaps that emerge from this literature that, while not the focus of this dissertation, I explore in the unusually rich data I have for California. First, most studies of school travel mode do not consider the type of school a student attends, assuming that all schools are conceptually the same. However, the literature suggests that transportation to public choice schools could be fundamentally different for those students. Studies have explored the transportation implications for choosing schools but have yet to explore the school choice implications for choosing a means of transportation. And second, residential self-selection is one of the most-often noted limitations in these studies and a threat to internal validity. In short, each of the studies I have discussed in this review—including my own—fails to answer this question: Does a child walk to school because it is the mode choice that most maximizes their family's utility, or do they walk to school because their parents picked their home location *because* it was close to a desired school?

Addressing these gaps will add to the literature by building a more complete picture of how institutions might influence students' travel behavior and, in preparation for that analysis, by developing an understanding of how these policies vary among states and within a given state.

3. Hypotheses, Data, and Methods

The prior studies reviewed above offer pieces to the puzzle of explaining travel mode choice for school trips, but the picture is far from complete. The role of policy and school transportation eligibility is a key missing piece in most of this previous work. To address this gap, I conduct five related analyses which together address various aspects of the following central research question: *To what extent are institutional factors associated with how students travel to and from school in the United States, controlling for student and school characteristics?* This is ultimately the story of the interplay between policy—which determines eligibility and institutional support for student transportation—and travel behavior.

Stemming from this overarching question, I present five analyses in the chapters that follow, each scaling down in geographic and temporal units of analysis. In Chapter 4, I consider how school travel mode selection has changed in four survey years of the 21st Century, with prior literature as a reference point. In Chapter 5, I examine the policies that determine transportation program eligibility across the 50 U.S. states. Chapter 6 applies these collected policies to reported school trips in the National Household Travel Survey (NHTS) across the 50 U.S. states. In Chapters 7 and 8, I present similar analyses for a sample of 119 California school districts and a subset of school trips in the NHTS California Add-On from those 119 school districts.

This chapter is an overarching methods section with content that applies to all these chapters. First, I explain my conceptual model for school travel mode selection. Second, I explain my overall hypothesis. Third, I justify my choice of study geographies. Fourth, I detail my data sources—including the two primary survey datasets, the policy data I collected to attach to them, and the secondary data I also attach to the surveys. Fifth, I explain how I measure key variables and variables I derived. And finally, I summarize the analytical methods I apply to each of the five analyses. Note that I leave the limitations of this dissertation to each individual chapter, as the limitations are specific to each analysis and the data it uses.

3.1. Conceptual Models

My study of children's travel to school and how families make travel decisions draws from the travel behavior literature about how people choose travel modes. I draw from the limited scholarship on school mode choice and offer areas where I believe there is a gap in understanding; in particular, this is the set of policies that help determine travel choice sets available to families, the findings about which are necessary for targeting appropriate policy interventions.

Personal (as opposed to commercial) travel behavior research draws on theories principally rooted in economics, psychology, and geography to explain travel choices (Handy, 2005; Singleton, 2013). In sum, the theories of travel behavior help us to understand how people make decisions about how, when, with whom, and to some extent where they travel. These theories (and the study of travel behavior generally) focus primarily on daily activities and trip-making in one's local area.

Travel behavior varies across different socio-demographic groups, especially along lines of income, gender, and race/ethnicity (Barajas, 2021; Blumenberg & Pierce, 2012), and across different built environments (Ewing & Cervero, 2010; Rahman & Sciara, 2022). These inequalities may arise in four ways. First, a family can lack the financial resources to provide transportation within the household itself. The most common example of this is a family without sufficient income to afford an automobile, or to afford enough automobiles to meet the demands of all household members. Second, a family can live in a neighborhood that limits the use of certain modes. This could be a sprawling suburban neighborhood with disconnected streets and no sidewalks that make it difficult for walking, an urban neighborhood with heavy vehicular traffic that makes bicycling dangerous, or a rural neighborhood with limited or no public transit service. Third, modes may not be available—or as available or desirable for certain populations—due to discrimination. A classic example of this is the increased likelihood of trip cancellation that people of color experience with taxicabs and, to a lesser extent, ridehail services (Brown, 2018). Fourth, and finally, a mode may be unavailable because someone is simply not eligible to receive it. A family generally cannot use a school bus if they live closer to their school than the school's transportation eligibility cut-off.

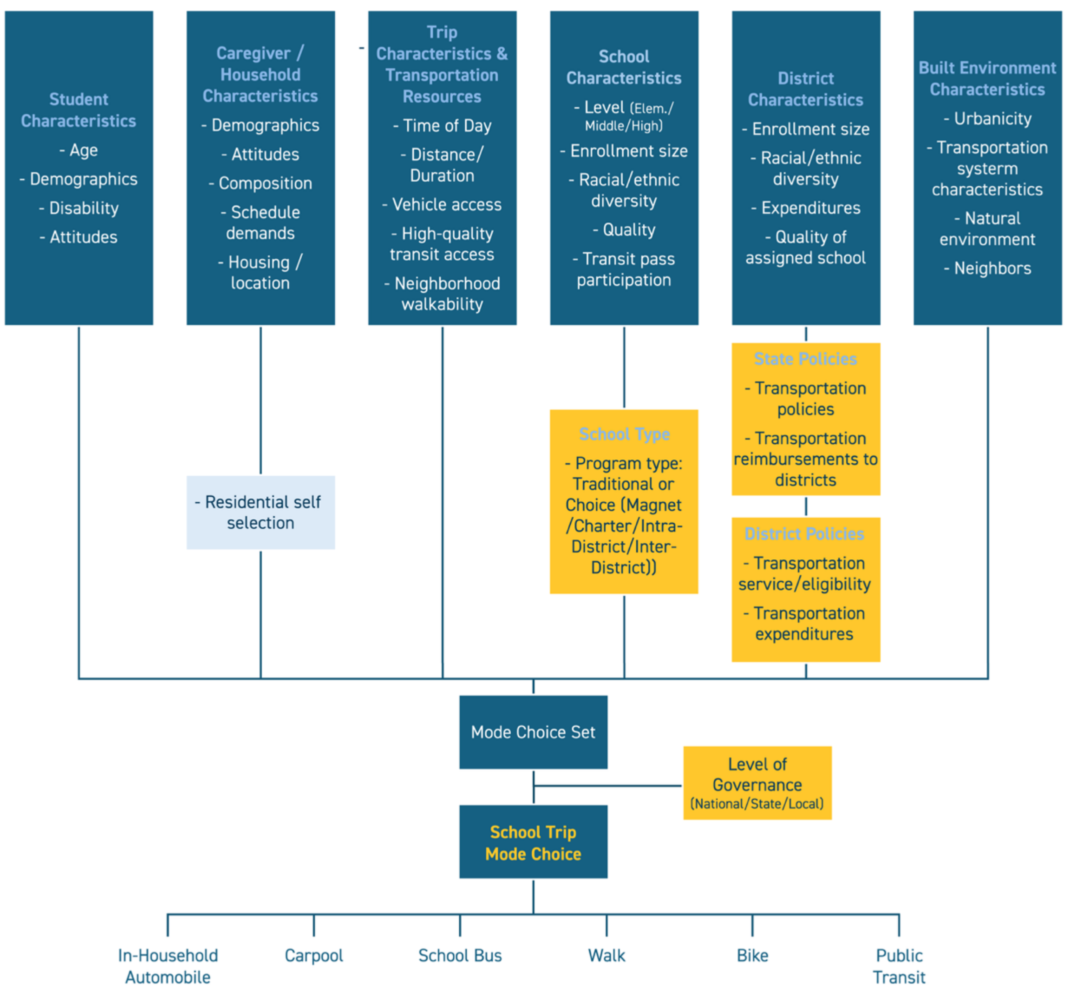
In this study, I am primarily interested in the difference between students who (A) receive school bus transportation as an option and (B) those who do not, either because the service is totally unavailable in their district or because service is available in their district but they are not eligible for it.

In keeping with tradition in the travel behavior literature generally (McFadden, 1974; Train, 1986) and in the school trip mode choice literature more specifically (McDonald, 2008a), I assume in this dissertation that students and their families choose their travel modes for school trips to maximize the student's and household's collective utility. Unlike adults choosing how to commute to work, the choice of how students commute to school is a joint one between students and their caregivers. (Although, with younger elementary students, parents may make that decision unilaterally.) Key to this framework is the "choice set"—that is, the suite of options available to families when they choose their travel mode for school trips.

In most prior studies, scholars have not fully built out this choice set, because it is exceptionally difficult to understand which students are eligible for a school bus. This means that for many studies, scholars have assumed that all students had identical choice sets, even when some may have had this major mode as an option while others did not. But the presence of the school bus option in particular changes the relative utilities that families and students can derive from each mode. For example, say a student lives 1.25 miles from school and walks, but the student also has the option for a school bus. Say the student also does not have the option of a ride from their parents who have work conflicts with school start or dismissal times. That student may walk because they enjoy walking, or because they can walk with friends, or a host of other reasons; if circumstances change, they could take the school bus. However, take the same student but without the option for the school bus. Those same reasons for their walking choice may still stand; but it is also possible, if not likely, that they are now walking because they *have* to. Reasons for seeking alternatives to walking—weather, comfort, safety, and many others—all matter in different ways depending on the choices available.

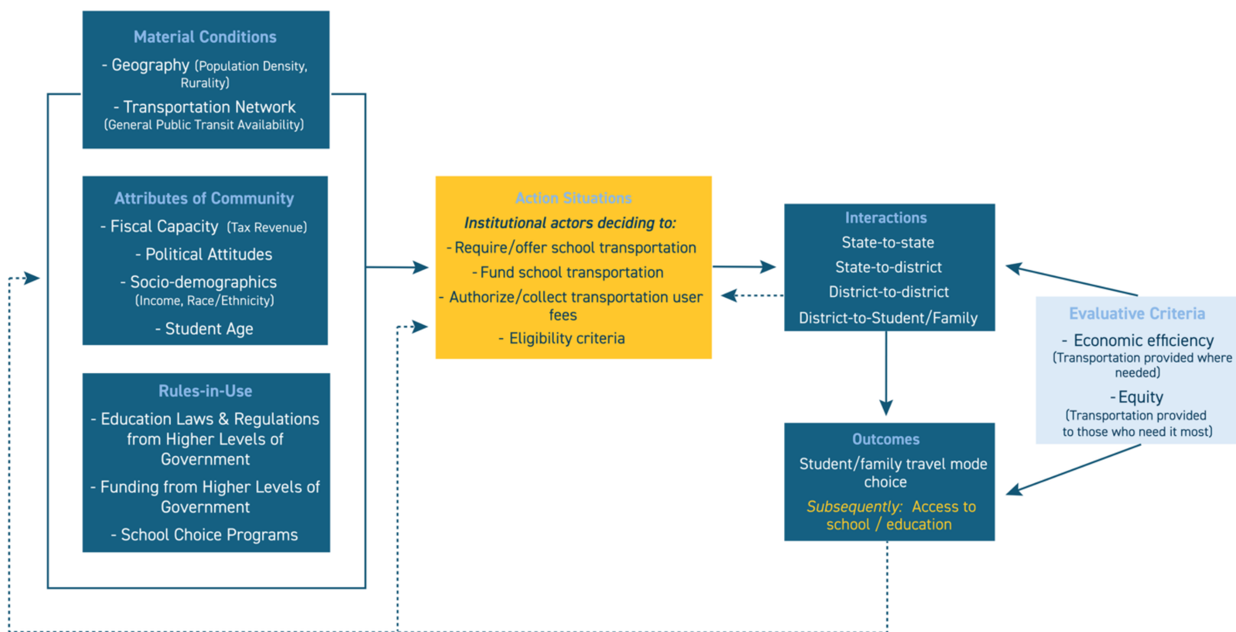
I view families' decisions about how to transport their child or children to school as being informed by six principal inputs: the characteristics of the student, the characteristics of the student's caregiver and household, the transportation resources available to the student, the characteristics of the school and, in turn, the district in which the student is enrolled, and the characteristics of the built environments around the home and school. Figure 2 presents a conceptual diagram of these relationships, with this dissertation's variables of interest highlighted in gold (and the other original contribution—controlling for residential self-selection—in light blue). This conceptual model motivates the analyses in the chapters that follow by positioning transportation policy as an upstream determinant of the travel mode choice sets available to students and families.

Figure 2: Conceptual model for travel mode selection for school trips



Informing the gold parts of the principal model in Figure 2 are the state and district school transportation policies that ultimately help determine a student's travel mode choice set. To examine how institutional actors create these policies, how they vary, and how they affect students and families downstream, I adapt Ostrom's (2009) Institutional Analysis and Development (IAD) Framework, which Ostrom developed to analyze how institutions affect individual and collective behaviors and, ultimately, policy outcomes. Figure 3 illustrates this framework as I apply it to this dissertation.

Figure 3: Conceptual model for school transportation policy design



In this framework, state and/or district transportation policy is a function of material conditions (like geography and the existing transportation network), the attributes of the community (such as its fiscal capacity, politics, and socio-demographic characteristics), and the rules of the community (such as the education laws and regulations governing the community from the above government(s), funding, and school choice programs). These factors play into how institutional actors—politicians, bureaucrats, and other state/district officials—determine which policies to implement and how to determine policy eligibility. These policies then interact with different levels of government and citizens—for example, state policies determine district policies, or district policies determine family decisions—which then ultimately lead to the outcome: student school trip travel mode choice. I intend to evaluate these on the grounds of economic efficiency (Do states/districts provide transportation to students *where* it is beneficial and do those students use it?) and equity (Do states/districts provide transportation to students who *need* it and do those students use it?).

This dissertation focuses on the characteristics of the school transportation policies themselves and the relationship between these policies and school trip travel mode. This hinges on the interactions square above—how states, districts, and students/families all work within the policies and programs above them to make travel decisions. The IAD framework also includes feedback loops (marked by the dotted lines in Figure 3), but these relationships are outside this dissertation's scope.

3.2. Hypotheses

Although there are five analyses in this dissertation, there are three methods across these five: repeated cross-sectional analysis, policy design analysis, and travel mode choice analysis. For the latter two, I apply those methods both to the 50 U.S. states and a national sample of school trips, and then again separately to a 119-district sample of California school districts and a California sample of school trips. Below are my hypotheses for each broad analysis.

First, I hypothesize that school travel mode significantly changed from 2017 to 2022. Specifically, I predict that school bus use will have dropped, while in contrast, private automobile use (in-household and carpool), walking, and biking will have increased, trends that are in keeping with post-pandemic travel changes in the broader population (Fan et al., 2022; Magassy et al., 2024; Morris et al., 2024; Siddiq & Taylor, 2025; Younes et al., 2023).

Second, I hypothesize that state student transportation policies are more likely to require districts to provide school bus service, more likely to fund school bus service, and less likely to charge user fees in rural, sparsely populated states, as compared with urban, densely populated states. I hypothesize the same as applicable for California school districts. I predict that state officials see more of a dire need for transportation in these districts, especially where public transit either does not operate or operates only sparingly. States with high shares of their populations living in urban areas may be more likely to see public transit as a means of fulfilling their school transportation obligations.

Finally, I hypothesize that school transportation policy is significantly associated with student travel mode choice. In particular, I hypothesize that eligibility for school bus service is positively associated with school bus use (perhaps obviously so) but also negatively associated with automobile use for school trips; in short, when families do not have access to a school bus, they fill that gap themselves using their cars and the cars of their carpool partners. I predict that this relationship will be even stronger in California, in part because school bus service is comparatively rare and because the availability of more granular data both on the policy and travel behavior sides allows for more precise analysis.

3.3. Geographic Rationale

While the first three analyses in this dissertation are national in scope, the latter two focus on California. The rationale for a national analysis is that it allows for an examination of the role of policy in school mode choice across states. My choice of California is not a matter of convenience; California offers three key advantages in analyzing school transportation.

Analysis of the U.S. broadly takes advantage of the variation of school transportation policy environments within it. In the U.S., the federal government's role in education has modestly expanded over the past three decades (Chingos & Blagg, 2017), but because there is no specific mention of education in the U.S. Constitution, most of the authority over education policy falls to the states. Thus, the policy landscape overall—and certainly the policy landscape for school transportation—varies substantially from state-to-state (McDonald & Howlett, 2007). This opens the opportunity to examine the contours of travel behavior across states with distinct policy environments.

The first reason for choosing to analyze California is similar to that of the U.S. Unlike many other states that have highly prescriptive rules about districts' school transportation programs, there is substantial variation in school transportation policy across the districts in the Golden State. Until 2022, California lacked any cohesive, mandatory policies about districts offering school bus service, and it had only minimal state funding for student transportation that did not vary depending on the transportation services that the district offered or even year-to-year (Kapphahn & Ehlers, 2014). This means that each district was generally free to offer whatever service it wanted, leading to diverse policy environments from district-to-district across the state.

Second, California provides a diverse transportation and education research environment that perhaps only three other states could conceivably match. California is home to over a thousand school districts spread over a geography that ranges from the nation's second largest city and metropolitan area to sparsely populated areas like the Mojave Desert and Northern California's forests. Further, California has several major metropolitan areas—seven metropolitan statistical areas (MSAs) over a million residents (U.S. Census Bureau, 2019)—that help to separate city-specific phenomena from state norms. The only other states that might offer similar variety, albeit on smaller scales, are Florida, Ohio, and Texas.[8] For example, in Speroni (2023) I found living in Greater Atlanta to be strongly associated with a student's probability for school bus use, but it was not clear if this is an *Atlanta* effect or an effect associated with major metropolitan areas in Georgia, because there is only one of those. In California, it can be clear whether an effect is, for example, a San Francisco effect or an urban California effect.

Third, and perhaps most practically, California is one of five states that had an add-on sample in 2017 NHTS that included both additional observations for within-state analysis and spatial location data

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[8] New York (Buffalo, New York City, and Rochester) can also claim three large MSAs, but New York City dwarfs the other two so substantially that the policy environment may not be as instructive.

for every destination to which a household member traveled on their travel day.[9] This unusually rich dataset includes a wealth of variables that have been often identified by other researchers as persistent gaps, including residential and school names and locations—which can be merged with myriad other data sources—and residential self-selection, that no other similar dataset for another state could match.

3.4. Data

The principal dataset for this dissertation is the National Household Travel Survey (Federal Highway Administration, 2001, 2009, 2017, 2022b). I make most use of the 2017 vintage, including the California Add-On. I also use the 2001, 2009, and 2022 vintages for the first analysis of change over time. But key to this research is two original datasets: a coded and categorized collection of the school transportation policies of each of the 50 U.S. states, which I refer to as the U.S. State School Transportation Policy Inventory, and a similar coded and categorized collection of the school transportation policies of a sample of 119 California school districts, which I refer to as the California School District Transportation Policy Inventory. There are also a variety of secondary datasets I attach to the California Add-On data, including data about school attendance zones, school program type (neighborhood zone, public choice, or private), school characteristics, transit service quality, and neighborhood walkability.

3.4.1. National Household Travel Survey Data

The National Household Travel Survey (NHTS) is the authoritative source of personal travel behavior data in the United States. And it is a workhorse: in 2022 alone, 420 research publications relied on NHTS data (Federal Highway Administration, 2022a). My first analysis in this dissertation (Chapter 4) uses the 2001, 2009, 2017, and 2022 vintages of the NHTS, drawing on the entire national sample for

[9] There were ten total add-on states in the 2017 NHTS. Arizona, California, Georgia, Iowa, and Wisconsin also included spatial data. These data included a description and geocoordinates for any destination to which a household member traveled on the travel day, such as home, work, school, shopping, appointments, and so on. Maryland, New York, North Carolina, South Carolina, and Texas had only additional sampled households and lacked spatial data. Only the California Add-On survey included questions about residential self-selection.

each. My third analysis (Chapter 6) uses the 2017 vintage only, again using the full national sample. And my fifth analysis (Chapter 8) uses the 2017 vintage but only the California Add-On.

Prior to 2022, the Federal Highway Administration (FHWA) conducted the NHTS roughly every five to eight years through a contracted survey research consultant by surveying a stratified random sample of United States households, asking questions about their household, its members, and their vehicles.[10] The centerpiece of the NHTS is an activity diary for an assigned travel day, wherein the survey asks respondents about each activity and their movements between each out-of-home activity—travel mode, trip distance, trip duration, and other attributes—throughout the assigned travel day. Table 2 below shows details for each of the four survey vintages, including response rate, travel day date range, and the numbers of households surveyed, K–12 students, and school trips included in the data.

Table 2: National Household Travel Survey information by survey year

Survey Year	Sampling Selection Method	Survey Response Rate	Travel Day Date Range	Households Surveyed	K–12 Students	School Trips**
2001	Telephone	32.2%	March 2001 – May 2001	69,817	28,284*	25,090
2009	Telephone	19.8%	March 2008 – May 2009	150,147	22,432	39,242
2017	Address-based	15.6%	April 2016 – April 2017	129,696	30,959	32,133
2017 CA Only	Address-based	12.9%	April 2016 – April 2017	26,099	5,970	5,784
2022	Address-based	10.8%	Jan. 2022 – Jan. 2023	7,893	2,220	1,617

* The 2001 NHTS does not include a variable indicating student status, so this is a tabulation of travelers ages 5–17.
** As defined in Section 3.5.1.

Because the 2017 vintage is key to several of my analyses and the only one from which I apply variables included with the survey data as covariates, it warrants more explanation here. For 2017, the NHTS used an address-based sample to mail invitation packages to households across the U.S., which

[10] The FHWA altered the NHTS program beginning in 2022 to begin collecting smaller samples in more frequent intervals. On the bright side, if this approach comes to fruition, it will allow for a better understanding of changes over time. On the less-bright side, smaller samples have removed key descriptive variables, like the state in which the households live, which will preclude studies like Chapter 6 of this dissertation.

included options for a return mail survey and links for participants to respond online. The primary respondent was the adult who completed the household intake form. Once successfully recruited, that adult then received and distributed survey materials to the remaining members of their household to complete on their travel day. Although survey data include travel diaries for all household members ages five and up, adult (i.e., a parent or guardian) proxies complete the diaries for participants ages 5 through 15. The survey dataset also includes a variety of variables about socio-demographics, employment, transportation resources, and residential location. The 2017 NHTS dataset includes travel days ranging from April 2016 through April 2017 (Westat, 2019).

The 2017 NHTS contains data on 129,696 households from all 50 states and the District of Columbia. Its overall response rate was 16 percent. Within these households there were 264,234 people, of whom 30,959 were students in a public or private K-12 school. Within this larger sample are add-on samples for ten different states: Arizona, California, Iowa (Des Moines and Northland areas only), Maryland, New York, North Carolina, South Carolina, Wisconsin, and Texas (with added observations from North Central Texas). Most of the households—both in total and among those with K–12 students—in the survey data come from these add-ons; the national sample is 26,099 total households, with a balance of over 103,000 in the state add-ons. The entire sample is stratified by the estimated sample sizes needed from each state, add-on or not. The NHTS includes replicate weights that are constructed such that researchers can apply them to national analyses or to a single add-on state. While the survey itself is not stratified for socio-demographic characteristics, the weights use a raking process to consider demographic categories based on American Community Survey data, including location in a metropolitan area with heavy rail (i.e., a subway), race, ethnicity, homeownership, number of household vehicles, household size, and number of household workers. Note that the presence of children was not a category used in weighting.

The California Add-On to the 2017 NHTS is the largest state add-on sample, with 26,099 households included. These households count both toward the national total *and* separately for

California, meaning the 26,099 households in California are also included in the 129,696 total households above.[11] This oversample includes 53,603 individuals, of whom 5,970 are K-12 students. Importantly, the confidential version of the California Add-On includes spatial data and descriptions for all home and trip destination locations in each respondent's travel diary, including school name and location. This allows for a broader range of potential explanatory variables than the national data—especially with the ability to identify each student's school. Additionally, the California Add-On includes a special question on why households chose their homes; in response, the primary respondent indicated if they chose their home due to the school district and/or convenience to school, among eight other possible reasons. Residential self-selection is another oft-lamented limitation of school-related spatial studies, and this question helps to address that issue.

The California Add-On sampling procedure is further stratified. The sample is allocated among eight regions of the state, and then sub-stratified by counties within those regions with over a million residents and heavy rail transit (like a subway), over a million residents without heavy rail, and counties with less than a million residents. The survey designers constructed this allocation to ensure that 20 percent of the sample comes from rural areas, an intentional oversample of California's rural population that is less than six percent of the state total (Johnson & Mejia, 2024).

For school travel, both samples include two sets of relevant questions. In the person-level data, respondents indicate their usual modes of travel to and from school separately, and the distance between home and school, calculated by the survey designers using the Google Directions API. And in the travel day data, respondents report on their trips to and from school in greater detail, including travel mode, trip departure time, trip arrival time, other travelers on the trip if not public transit (e.g., a parent chauffeur or a fellow student from another family in carpool), and any transfers of mode (e.g., a parent drives the

[11] It is merely a wild coincidence that both the California sample and the national sample not part of any state add-ons were both 26,099.

student to a school bus and then the bus takes the student the remainder of the way to school). For this analysis, I use the travel day mode choice, because the travel day behaviors are less subject to recall bias.

Beyond the key outcome variable of travel mode, the NHTS includes a wide variety of questions and data points about individuals, households, trips, and the built environment. I employ several of these as covariates as I explain below, as pertaining to the student and the student's parents/caregivers.

3.4.2. Policy & Eligibility Data

To examine the policy environments in which the reported school trips in the NHTS took place in both the national and California analyses, I collected policy and eligibility data in two waves: a 50-state inventory (districts and territories excluded) for all relevant state policies, and then for a 119-district sample of California school districts. For the U.S. analysis, I restricted my collection to policies about students attending their primary assigned public school, as policies about public choice and private school transportation varied too widely state-to-state to achieve a systematic comparison that could be applied to individual travel data—and the publicly-available NHTS national sample does not include this information or a way to derive it. For the California analysis, I collected separate policies each for students attending their assigned public schools and for those attending choice schools; California does not have any legislation about private school transportation. For both datasets, I collected data on school bus service eligibility, funding data, and user fee programs. Table 3 summarizes the content and sources of these two data collections.

Table 3: Policy inventory data collections

Variable	*Data collected* U.S. (by state)	California (by district)
Sample	*All 50 U.S. states (districts and territories excluded)*	*119 California school districts drawn from those NHTS respondents attended*
Sources	*State education statutes and administrative codes*	*California school district websites*
School bus service eligibility	State statutes, whether trips were mandated and, if so, at or beyond what distance from home-to-school students must live	District transportation program websites for school bus eligibility requirements
School transportation funding	Whether state has a formula for funding	Amount of state funding received from the state's 2016–2017 Home-to-School Transportation (HTST) Fund
User fee program	State statutes authorizing and/or prohibiting school districts charging transportation user fees to families	From district transportation program websites for school transportation user fee programs
Reimbursements to families for self-provided transportation	State statutes authorizing and/or prohibiting school districts reimbursing families for self-provided transportation	Not applicable to California (not authorized by state)

For the U.S. policy data collection, I modified a framework established by McDonald and Howlett (2007). Recall from the prior chapter that their framework was (paraphrased):

1. Does the state mandate that districts provide student transportation?
2. Does the state reimburse districts for providing student transportation?
3. What are the eligibility requirements for students to receive transportation and/or for the districts to receive reimbursement of costs for doing so from the state?

I conducted an initial ten-state survey (of the ten NHTS add-on states) of these policies using the McDonald and Howlett framework. In addition to considering the case studies they presented in their article, the results of that preliminary survey led me to develop my own modified framework:

1. Does the state mandate that districts provide student transportation, and if so, who is eligible by grade (K–12)?

2. Does the state reimburse districts for providing student transportation, and if so, who is eligible by grade (K–12)?
3. Does the state permit districts to charge transportation user fees to families?
4. Does the state permit districts to reimburse families for providing their own transportation in lieu of the district providing it?

Because the first two elements of this framework are largely based on the third (i.e., most states mandate that districts provide transportation to students who the policy determines to be eligible), I consolidated these two steps. This is a more complicated approach than McDonald and Howlett (2007), but this added complexity is necessary in order to match policy characteristics to school trip characteristics. I also found substantial variability in user fee and family reimbursement payment policies, so I added those to my framework as well.

To gather these data, I relied on Westlaw's collection of state statutes and administrative codes, which allow for searching the statutes of each state and tracing their legislative histories. Critically, Westlaw also allows users to back-date the statutes, so that I was able to standardize my searches for statutes and codes as of January 1, 2017—roughly in the middle of the NHTS travel data collection period. I searched each state's education statutes and administrative codes for key words and phrases, including: school transport, school bus, transport funding, transport reimbursement, and transportation fee. If any of the elements of my framework were not readily apparent in my search of state statutes and codes, I took four additional steps, in order. First, I checked the relevant general sections of each state's code (e.g., I checked the education funding section of the code for the transportation funding formula under different wording or to see if it was included at all). For most states, this was sufficient. Second, I checked the state's department of education website for transportation information—at times this information was intended for families, while at other times it was intended for school district officials. Third, I checked the academic and grey literatures for references to state school transportation legislation; this included a small number of scholarly articles (although most were dated, their citations to the state education codes were often still relevant) and more frequently reports to state legislatures taking up the issue of school funding reform. And fourth, I searched school district websites in a given state to see if and how the district officials were interpreting state law.

I applied this same framework to the California data collection, but as applied to school district policies and programs. There is one key conceptual difference between the state policies and district programs, and then two more practical differences between my U.S. state data and the California data.

First and conceptually, unlike state policies which establish a baseline level of service that districts must offer, district policies reflect actual implementation; that is, unless by exception, this is the service that students experience. For example, suppose again a student lives 1.25 miles from school, and they live in a state that requires districts to provide school bus service to students living two or more miles from school. Although the state policy does not require that this student must receive school bus transportation, the district provides school bus transportation to all students living a mile or more from school. Here, the district policy is a more precise measure of the students' actual options. In California, there is no service mandate, so district policies are the only relevant measure of the transportation offered to students. The same conceptual difference applies to the user fee policies as well.

Second, rather than comparing whether a funding formula exists as I did with U.S. states, a single state allows for capturing the actual funding amount. California did not have a funding formula in 2016–2017, but it did allocate a small set amount to districts for transportation that did not change year-to-year, fixed in 1982 and reduced by 20 percent in 2008 (Kapphahn & Ehlers, 2014). I applied this measure to the funding criteria. And third, because the California NHTS data allow for me to determine whether a student attends their district-assigned zone school, a public school of choice, or a private school, I collect policies for both types of public schools.[12]

[12] Private school data are less commonly published and publicly available than public school data, including about transportation service offerings, so I exclude these from my data collection other than labeling a student as attending a private school.

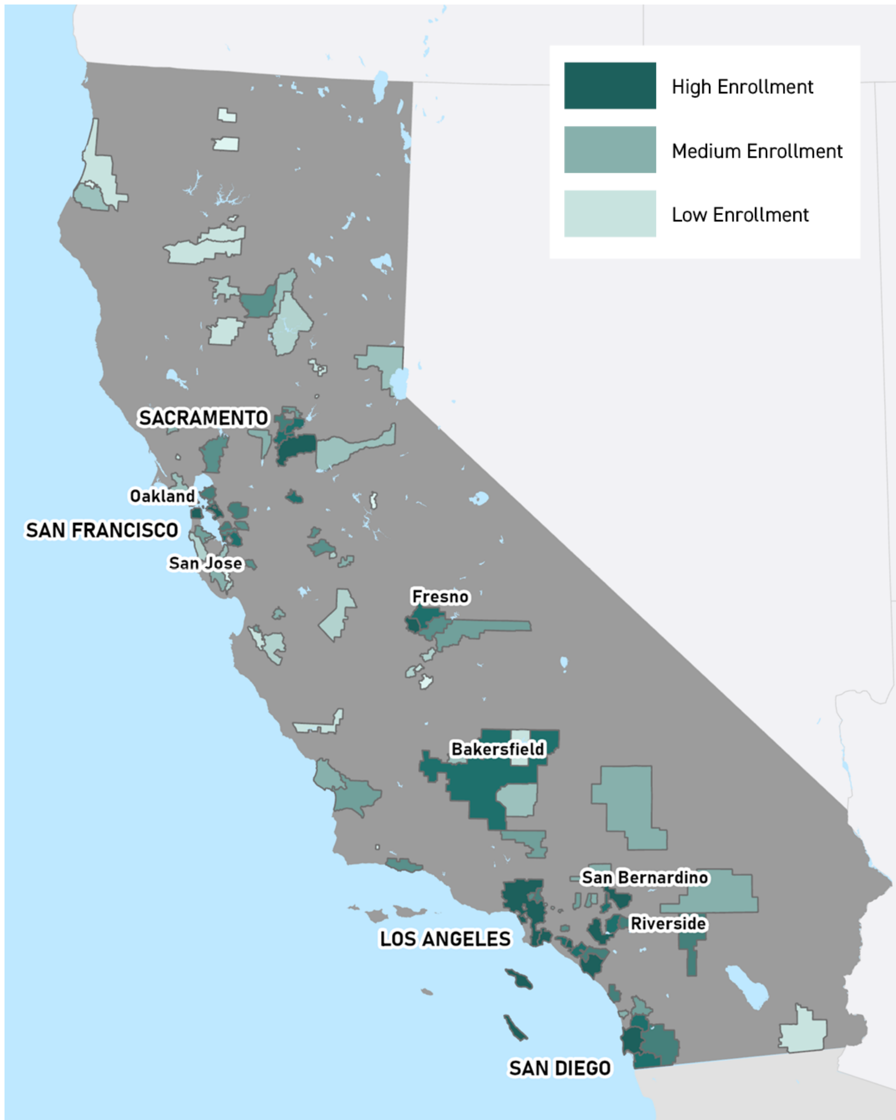
The California school transportation program data come from a different, prior project. The full explanation of the process can be found in that project's report (Speroni et al., 2025), but I provide a short summary here. I developed a sample of California school districts for which I could manually collect transportation program data, because this manual data collection was both time and resource intensive. I began by identifying the 616 school districts that NHTS respondents attended, which included roughly 61 percent of the state's districts. (There were 1,002 school districts in total in California for the 2016–2017 school year.) From there, along with a research team of students that I supervised, I selected 119 districts for data collection in four parts: (1) a stratified random sample of 83 school districts, (2) an add-on sample of the remaining 22 large school districts in the NHTS sample, (3) a second add-on sample of 11 small or medium districts with students who used public transit in the NHTS, and (4) the three charter-school-only districts that NHTS students attended. I detail the process of each below.

First, for the stratified random sample of 83 districts, I stratified on the type of district (elementary only, high school only, or unified), the region of the state, the built environment type, student enrollment, student socioeconomic status, student race/ethnicity, and the share of adult commuters in the district who used public transit to commute to work. Second, after I had chosen these 83 districts, I added the remaining 22 large school districts (those with enrollments of more than 30,000 students). These districts are especially important because they dictate the transportation offerings experienced by a large percentage of students in the state, even if they make up a small percentage of districts. Indeed, 28 percent of all students attend just these 25 largest districts. Third, I added 11 districts in which students in the NHTS had taken a public transit school trip, because public transit use proved to be rare.[13] Ultimately, even with the add-on districts, I found the sample to be generally representative of the state as a whole across all seven stratification categories (within five percentage points), with expected slight

[13] Note that ultimately it proved so rare that I had to exclude this mode from the model. Descriptive statistics are unaffected because I either report those for the entire NHTS sample or I exclude public transit when reporting trips taken only in districts with transportation program data.

overrepresentations of students in large districts. Figure 4 displays this sample on a map, with larger districts shaded darker green.

Figure 4: Map of sampled California school districts, shaded by enrollment



Data Source: California School District Transportation Policy Inventory, NCES SABS, NCES CCD

After developing the sample, I directed a team of undergraduate student researchers to role-play as parents of students searching district websites for school transportation information. The student researchers searched for this information under two scenarios: (1) the parent of students in elementary, middle, and high schools seeking to ride the school bus to their assigned neighborhood zone school, and (2) the parent of students in each of the three school levels looking for school bus service to public choice schools (if the district had choice programs). In scenarios where school transportation information was not available, the researchers placed phone calls to school districts to confirm that the district did not offer the service. The researchers collected data using a similar framework as above in the national analysis, but twice—once for neighborhood zone school students and once for public choice school students:

1. Does the school district provide student transportation, and if so, who is eligible by grade (K–12)?
2. Does the district charge transportation user fees, and if so, in what amount?

3.4.3. Other Secondary Data

In addition to these primary data sources, I use a variety of secondary datasets for covariates and/or to derive covariate measures. These additional data are involved in three of the five analyses: both policy design analyses (U.S. states and California districts) and the California travel mode choice analysis. Because the national NHTS is largely anonymized, I do not add any variables to those models beyond the policy measures I just described above to either national travel mode analyses (in Chapters 4 and 6). I describe each dataset and its general purpose below for the three analyses to which they apply, and I explain the relevant measurements in the next section.

For the policy design analyses, I use:

- **American Community Survey (ACS) 5-year estimates 2015–2019:** I use state and school district estimates for a variety of sociodemographic characteristics, including population, population density, median household income (in 2017 USD), race/ethnicity, poverty rate, educational attainment, and transit commuting (U.S. Census Bureau, 2019).
- **2020 U.S. Decennial Census:** Not available in the annual ACS, I use the 2020 Decennial Census to identify the population living in rural areas (U.S. Census Bureau, 2020).

- **U.S. Bureau of Economic Analysis Gross Domestic Product (GDP) by State Estimates:** I use these estimates of state-level GDP per capita, normalized to 2017 USD (U.S. Bureau of Economic Analysis, 2023).
- **National Center of Education Statistics (NCES) Common Core of Data (CCD):** The NCES CCD includes state-level and school district-level data on per-pupil expenditures, tax revenue, and the numbers of students and schools per district and state, and the number of school districts per state (Urban Institute, 2024). These data are drawn from the Annual Survey of School System Finances (F-33), and although these data reliably include district-level expenditures on transportation, they do not consistently include state payments to districts for transportation.[14]
- **California Department of Education (CDE) Local Control Funding Formula (LCFF) Annual Apportionments:** These data include the amounts that the state distributed to school districts as part of its Home-to-School Transportation (HTST) Fund in the 2016–2017 school year (California Department of Education, 2019).
- **State Ideology Score (Fording, 2018):** This score approximates the political ideology of a state. (Again, see more in the measurement section.)
- **California Statewide Database (SWDB) Election Results:** I draw election results at the precinct level—which I then aggregate to the school district level—for the 2014 gubernatorial election and the 2016 presidential election in California (Statewide Database, 2024).

[14] There is a line item for districts to report the amounts of funding they received from the state for transportation purposes. However, in examining the data for several states for this dissertation, including Arizona, California, and North Carolina, I found that the revenues received as reported by districts and the funds distributed as reported by states differed substantially. Thus, I am not confident enough in the data to include the state-to-district payment amounts in this dissertation.

For the California travel mode analysis, I add the following data sources:

- **NCES Student Attendance Boundary Survey (SABS):** The SABS was an experimental survey that recorded and produced spatial data for nearly all school attendance boundaries across the United States, including California. Although the data were for the 2015–2016 school year and thus not an ideal match, these are by far the best available data for deriving a student's assigned zone school and cover the first three months of the NHTS travel day observation period (National Center for Education Statistics, 2016b).
- **NCES Common Core of Data (CCD) and EdFacts, via the Urban Institute Education Data Explorer:** The CCD and EdFacts include data on school location, socio-demographics, and achievement (Urban Institute, 2024).
- **NCES Private School Survey (PSS):** The NCES PSS includes the spatial location of nearly all private schools (National Center for Education Statistics, 2016a).
- **California Department of Transportation (Caltrans) High-Quality Transit Service Areas:** This database includes all "high-quality" transit stops statewide, which the state defines as any bus or rail stop at which a bus or train stops at least every 15 minutes during peak hours (Caltrans, 2022).[15]
- **National Walkability Index:** Produced by the U.S. Environmental Protection Agency, the index rates the walkability of each census block group on a scale of 1 to 20 based on a variety of factors. The agency considers scores above 10.5 to be "above average walkable" (U.S. Environmental Protection Agency, 2019).

[15] The state also considers ferry stops and transfer points to meet this definition; however, I choose to include only stops that strictly meet the frequency definition given the needs of students traveling to/from school.

3.5. Measurement & Variable Justification

3.5.1. Policy Characteristics

To classify the four key aspects of school transportation policies at the state and school district levels, I largely rely on constructing binary measures to indicate whether the state or district had that policy attribute in place. While I detail the specifics of these analyses as I describe my findings in chapters 5 and 7, I provide an overview of this classification in Table 4.

Table 4: State & district school transportation policy measurement

	U.S. States		*California Districts*	
Variable	**Policy Design**	**Applied to Trips**	**Policy Design**	**Applied to Trips**
School bus service eligibility	Yes / No (Yes if any age has mandated service)	Yes / No, based on student distance from school	Yes / No; If yes, then miles from home to school for eligibility	Yes / No, based on student distance from school, or yes for fixed-route service available
School transportation funding	Yes / No (Yes if any age has state funding)	Yes / No, based on student distance from school	N/A	State funding per pupil for transportation
User fee program	Yes / No (Yes if required or authorized)	Yes / No, based on student state of residence	Yes / No	Yes / No
Reimbursements to families for self-provided transportation*	Yes / No (Yes if required or authorized)	N/A	N/A	N/A

* Not modeled, but I do present descriptive statistics for this measure.

The table shows how I measure the four aspects of these policies for both the 50 states and the California school district sample, and then within each of those, it shows how these vary depending on whether I am analyzing the policy design or applying the policy to individual student trips in the NHTS. To apply these eligibility thresholds to the school trips in the NHTS, I use the variable included in the NHTS for the distance in miles from home to school, as measured using the Google Directions API. This provides the clearest indication of transportation *eligibility* based on distance, as compared with the school trip distance which might include stops for picking up carpoolers, route deviations as part of using public transit, stops for morning coffee, or origins/destinations other than home.

For the U.S. analysis, I include detailed descriptive statistics around these measures, including eligibility thresholds based on distance from home to school for service mandates and funding eligibility, funding formula type, and legislative method for user fees and family reimbursements. I consolidated the four policy attributes into yes and no binary variables. While this approach does limit my ability to assess some of the within-state nuance between each category—for example, differences in school bus eligibility by school age level or types of transportation funding formulas—the binary indicators are both illustrative and well-suited to the model form I describe in the next section.

As Table 4 shows, I exclude measures for school transportation funding for California districts and reimbursements to families for all analyses except the descriptive analysis for the United States. I expand on the reasons for this in the coming relevant chapters. In short, first for school-to-family reimbursement policies, it is difficult to approximate the policy effect on trip outcomes because they vary so widely and require additional steps on the part of the families to request those funds. And second, I do not model the policy design of California's former Home-to-School Transportation (HTST) Fund because (A) the amount of funding allocated to districts was not regularly adjusted by formula but rather was simply a fixed annual allocation frozen in 1982 (with a percentage reduction in 2008), and (B) the HTSF is no longer the current policy. Finally, I do not model or describe reimbursements to families in California because state policy does not permit districts to pay families in lieu of providing transportation.

3.5.2. School Trip Travel Mode

The principal dependent variable of this dissertation is the means of travel students take for their trips to and from school—the school travel mode. To identify travel modes requires two steps. First, I identify what constitutes a school trip. To do so, I select all trips that meet the following criteria:

- A trip that the respondent or respondent proxy identifies as having a destination or origin purpose of "attending school as a student." (Students do not complete their own forms from ages 5 through 15; a parent/caregiver proxy completes them on their behalf.)
- A trip with the traveler's age between 5 and 17. (Note: the NHTS does not include 18-year-old students as those identified as public or private school K–12 students.)
- A trip taken by a student whom the respondent has identified as attending school at a public or private school campus and not as a homeschooled student.
- A trip with a duration of between 1 and 120 minutes. (Trips of zero duration are not possible unless the student literally lived at school; trips over 120 minutes are likely one-off trips from unusual origins other than home or irregular trips to boarding schools, for example.)
- A trip that occurs on a weekday during the academic year, August through June. (Many California school districts operate in parts of June and August, but in July as well as on weekends, most reported school trips would be to specialty programs or summer school programs outside the normal school schedule.)
- A trip that occurs with school as a destination and ends between 5:00 AM and 10:00 AM, or a trip that begins at school between 1:30 PM and 6:00 PM. This is to limit my focus to peak-hour, peak-direction trips, and to exclude one-off trips such as those to a mid-day doctor's appointment.

These criteria collectively eliminate roughly six percent of NHTS trips with identified purposes of attending school as a student, mostly due to the time-of-day constraints.

From there, I determine the travel mode the student used on each trip. For the most part, this is a straightforward exercise: most students used only one mode. The NHTS has a complex code of more than 20 different travel modes, which I consolidate into six principal modes for school purposes: automobile (in-household), carpool, school bus, walk, bike, and public transit. Table 5 outlines these definitions and provides an example of each; it also displays the color I assign to each mode in all figures throughout this dissertation.

Table 5: School travel mode definitions

Color Code*	Travel Mode	Definition	Example
	Automobile (In-Household)	Only members of the household traveling in the same vehicle	A student riding in a car with her mother driving.
	Automobile (Carpool)	Trip-taker in vehicle with people outside of their household	A student riding in their neighbor's car; *or* a student riding in their father's car along with their sister and their sister's friend.
	School Bus	School-operated bus designed for and only open to students	A student boards the school bus near their house and is transported to school.
	Walk	Walking only	Walking only.
	Bike	Bicycle only	Bicycle only.
	Public Transit	Fixed-route, fixed-schedule general public bus or train	A student walks a short distance from home to the transit bus stop (e.g., Los Angeles Metro) and rides the transit bus to a stop near school.
	Other *	Includes taxi, ridehail, ferry, golf cart, motorcycle, and others	These are unusual cases that rarely appear. One eccentric example is students using golf carts for school trips in Peachtree City, Georgia. Another is a member of the California data collection research team who rode her unicycle to school in fourth grade most days.

* Other than the blue shades for automobiles, these colors are intentional. Yellow is the color of a school bus. Walking is grey because it is closest to white, which is the outline color of the stick figure for the pedestrian phase on traffic signals. Green is the color of bike lane paint. And orange is the color of most of Los Angeles Metro's bus fleet.

Note: The NHTS asked respondents to write in their travel mode if it was "Something Else" other than the 20 common modes listed. While the national data redact this variable, it is available in the California data. The statistical consultants then categorized the responses in post-processing, which include: passenger of an unknown mode, scooter/skateboard/roller-skates, and wheelchair/mobility scooter. Across all trips in the NHTS, responses also included horse-drawn vehicles, emergency vehicles, and agriculture vehicles. Although unicycle did not appear in the data, if it had, I would classify it here as "Other."

There are a few key steps I take in differentiating from what is reported in the NHTS data. First, the NHTS records the type of automobile or public transit mode (e.g., bus or train); I consolidate these because a family is probably not deciding their school travel mode based on whether they have a sedan or an SUV. Second, I disaggregate automobile travel into two categories: trips that occurred with *only* members of the student's household in the vehicle ("in-household") and trips that occurred with at least one passenger or driver who does not belong to the student's household. Single-family trips potentially pose greater costs on the transportation system, while carpools cause less harm; however, high rates of carpooling might also signal a population potentially being underserved by formal school transportation programs. Third, I filter a small number of multiple-mode trips into the following hierarchy: any trip that involves a school bus is a school bus trip, even if a family used an automobile to transport their student to the bus stop; any trip that used public transit is a transit trip, even if a student walked to the train station; and any walk trip must include only walking. These multi-mode school trips were rare: less than two percent of trips, at least as reported.

3.5.3. Other Key Variables: Policy Design Analyses

Most of the variables I use for the policy design analyses come directly from the data sources described above. However, I derive a few key measures. Those are:

Neighboring state and district policies: To consider the possibility that states' and school districts' policies are similar to those of their spatial neighbors, I construct variables that calculate the percentage of neighboring districts with a "yes" policy across all three outcome variables: service mandates, funding formulas, and user fee authorizations. For the states, this is simply any state with a border that touches the target state. For example, California's neighbor variable would be the percentage of "yes" policies among Oregon, Nevada, and Arizona. (As in Wong and Langevin (2007), I omit Alaska and Hawai'i from this variable.) For the California districts, this calculation is less straightforward. As Figure 4 illustrates above, the nature of the sample is that many districts' direct neighbors are not included in the sample. To work around this, I calculated the neighbor variables for all sampled districts among the same school level and choice program status (see below for explanations of how I construct those variables) within an increasing mileage threshold until I identified four or more nearby districts in the sample for which I have transportation eligibility data. For any district with four or more sampled neighbors within 20 miles, I used that calculation, then again for 50 miles, and then finally again for 100 miles. These cut-offs come from the following logic: 20 miles is roughly the 99th percentile of school trips by distance in California (as calculated using the 2017 NHTS); 50 miles is what transportation scholars consider a "super-commute" (Blumenberg et al., 2025); and 100 miles is roughly the 99th percentile of all adult commutes in California by distance (again using the 2017 NHTS). Ultimately, these represent the distances—in some cases extreme—that parents/caregivers could choose to commute to their jobs from homes in a target school district, thereby creating areas in which other school districts would conceivably compete to offer educational services that would entice families to choose homes and enroll their students there.

Government ideology: To consider the possibility that U.S. states might have more or less generous school transportation policies if a given political party held relatively more power, I relied on data from Fording (2018), which used a method developed by Berry et al. (1998) to estimate a Government Ideology Score. In short, this is an index that ranges from 0 to 100, with 0 signifying complete Republican control and 100 meaning complete Democratic control. I prefer this measure to a categorical representation of party control for two reasons: first, it captures the strength of each legislative chamber beyond just a binary, and second—and most practically—a continuous variable has more variability and requires less statistical power to detect a significant relationship with the outcome variable amid my limited-size sample than a binary version of the variable would.

Election results: To consider the possibility that California school district transportation programs are more or less expansive if its citizens lean in a given direction politically, I calculated the results of the 2014 gubernatorial election and the 2016 presidential election using precinct level data. I matched the precinct spatial data to the school district shapefiles and aggregated the results. Voting precincts (and most other spatial units) do not map neatly onto school districts, so I counted any precinct that overlapped with a school district, even if it did not do so in its entirety.

3.5.4. Other Key Variables: Travel Mode Analyses

Again, most of the variables I use in the travel mode analyses I draw from the NHTS directly. However, I constructed some unique national and California variables from NHTS variables, and I constructed some additional variables for the California data from secondary data sources.

National and California data:

School level (elementary, middle, and high): The NHTS includes only age in years, but school transportation policies are generally applied to grade levels in school, often roughly in increments of elementary, middle, or high school. To approximate this relationship, I assign students to school levels based on the following age criteria: ages 5 through 11 are elementary school students, ages 12 through 14 are middle school students, and ages 15 through 17 are high school students.[16] These ages are not perfect delineators. For example, a 14-year-old may be an old middle school student or a young high school student, and their travel behaviors may change based on that distinction. In the national data, I estimated an additional model to assess this possibility, with 11-year-old students classified as middle schoolers and 14-year-old students classified as high schoolers. The results were nearly identical. In the California data, because I have access to the name of the school the students attended, I cross-reference this with the school's grade levels offered to ensure greater accuracy in assigning students to school levels.

Disability: The NHTS includes a variable for the traveler's disability status. Because the survey question is focused on travel and mobility, the question only provides response options along

[16] As mentioned in my description of the data above, the NHTS does not include 18-year-olds as K–12 students.

those lines and does not include options to indicate intellectual disability. This is an important distinction because federal law requires schools to offer transportation to students if it is included in their individualized education programs (IEPs), which schools use to ensure students with disabilities have access to their education. Unfortunately, NHTS data does not afford the option of including these disabilities in this variable.

Parent/caregiver flexible work schedule: The NHTS includes questions on parent employment status, including whether they are employed, if their job is full- or part-time, if their job offers a flexible schedule, and if they work remotely. Conceptually, if a student's parent has greater flexibility in their schedule due to flexible or decreased work demands, they are more available to chauffeur their student(s). To consolidate this into a single variable, I indicate that a student has a parent with a flexible schedule if at least one parent has at least one of the following: no job, only one part-time job, a job with a flexible schedule, or works remotely.

Household vehicle status: Although commute trips and school trips are often at the base of the family travel planning pyramid, the number of vehicles available—and the drivers demanding use of those vehicles—is important in determining how families transport their children to school. To approximate this, I divide the number of vehicles each household owns by the number of licensed drivers in the household.

Major metropolitan area: In the U.S. analysis, I use only a binary variable to indicate if the trip occurred in a major metropolitan core-based statistical area (CBSA). For the California analysis, I expand this to become a categorical variable for all metropolitan areas in the state with over 900,000 residents (from largest to smallest). Due to sample size restrictions, I condense these into larger metropolitan areas: San Joaquin Valley (the Bakersfield and Fresno CBSAs, which include Kern and Fresno Counties), Greater Los Angeles (Los Angeles, Orange, Riverside, and San Bernardino Counties), Sacramento (El Dorado, Placer, Sacramento, and Yolo Counties), San Diego, and the San Francisco Bay Area (the San Francisco–Oakland and San José CBSAs, which include Alameda, Contra Costa, Marin, San Francisco, San Benito, San Mateo, and Santa Clara Counties).

California data only:

Type of school program attended: I use data developed for a prior project that identifies the type of school a student attends: their assigned neighborhood zone school, a public school of choice, or a private school. A full explanation of this process can be found in Speroni et al. (2026), and I summarize that process here. We merged the confidential school location and home location data from the NHTS with the school location data and attendance catchment areas (the spatial polygons that delineate the school to which a district assigns a student) to determine both the school the student attends and the list of possible schools a student could have been assigned to attend. First, we used a hierarchy of methods including geographic coordinate matching, fuzzy string text matching, and manual decoding and pairing to identify the school a student attends. Second, we used students' home geocoordinates to match those with the school attendance catchment areas in the Student Attendance Boundary Survey (SABS) data. If the school a student attended matched with one of the possible assigned schools based on overlap of their home geocoordinates, then we labeled them as a neighborhood zone student. If they attended a school that either did not have a catchment area because it is a full "choice school," or if they attended a school with a catchment area that did not include their home, we labeled them as a choice school student. And if they attended a private school, we labeled them as a private school student.[17]

[17] There were many nuances to these classifications that my co-authors and I explain in much greater detail in the article cited here. One relevant example includes students who might attend a magnet program or charter school that *is* their assigned neighborhood school. For example, the school at which I taught in Charlotte, North Carolina, had both a neighborhood zone school program *and* a smaller magnet program that drew from a larger attendance zone that the neighborhood zone. A student in the neighborhood zone could have participated in the magnet program. In these instances, because we only had school name in the NHTS data, we labeled these students as neighborhood zone school students. Conceptually, we felt this was justified because we were interested in issues of spatial access and not in whether a student was enrolled in the general education program or choice program within their assigned neighborhood school's building. (We would have taken a different approach if we were interested in the downstream effects that transportation had on academic performance.) Similarly in this dissertation, I am interested in travel, and the reason I am interested in choice school students is because they tend to live further from school than neighborhood zone students.

Rationale for selecting home: The California Add-On includes a question that asks households to identify three reasons they chose their home. Two of the 11 possibilities are school-related: the quality of school district and the convenience to school.[18] This question allows me to proxy for residential self-selection, the idea that the oldest form of public-school choice is parents choosing their homes *because* of the school to which that home is assigned. I construct two binary variables to indicate each of these selection rationales.

Transit access: To approximate students' abilities to take public transit for school trips, I use the stop-level data from the Caltrans High-Quality Transit Area database. I draw quarter-mile buffers around each high-quality transit stop and label the trips taken by students who live inside one of those buffers.[19]

Neighborhood walkability: To approximate the walkability of a student's neighborhood, I use the EPA's National Walkability Index. I consolidate their four categorical scores into "below average walkable" and "above average walkable."

Finally, in both the national and California analyses, I control for built environment typologies using data included in the NHTS. Even though both of my primary data sources are from the National Household Travel Survey, the methodologies (and creators) of the built environment typologies differ for the national data and California data. The national data use a five-category variable—urban, suburban, second city, town, and rural—constructed by the consulting firm Claritas for the NHTS. Claritas analysts classified census blocks based on population density centiles and proximity to urban areas (Westat, 2019). The California data use a typology developed by Clifton et al. (2018) that relies on six indicators to

[18] While this survey question offers unusually rich insights, one key limitation of it is that it asks respondents about the quality of the school *district* and not the school to which their student is zoned. In smaller districts, this distinction is negligible, but in larger urban districts, there are wide ranges of school quality.

[19] Walker (2012) identifies the industry consensus walking distance threshold beyond which people become less likely to walk to public transit stops as between 0.25 and 0.5 miles, depending on the frequency and speed of service. Here, I use the narrower threshold because our research subjects are children, whose parents may hesitate to allow for longer walking distances, especially unaccompanied.

develop five built environment categories (different from the Claritas categories): urban core, urban district, urban neighborhood, suburban neighborhood, and non-urban. Inputs include population density, job density, type of housing, intersection density, job access via transit, and job access via automobile. To streamline and maintain degrees of freedom with a limited California school trips sample, I condense the three urban categories into one.

3.5.5. Justification for Policy Design Predictors

The variables that I use to predict state and school district policy design are drawn from the literature on various other education policies as presented in the literature review (see Section 2.3), including and especially charter school adoption. Because there are no such systematic studies of school transportation policies, I am unable to draw on any prior literature there.

3.5.6. Justification for Travel Mode Predictors

The variables that I use to predict school trip travel mode choice are drawn from the literature, as shown in Table 1. The chief contributions of this dissertation are adding three key groups of variables to the prior scholarship: state/district school transportation policies, the types of schools that students attend, and the ability to control for the possibility of residential self-selection. Importantly, these additions allow me to discern not only if policy has a significant association with school trip travel mode choice but also if it alters the assumptions established in the prior literature.

3.6. Analytical Methods

3.6.1. Change Over Time

To analyze whether school travel mode choice is changing over the first quarter of the 21st century, I use descriptive statistics, confidence intervals, a weighted Pearson chi-square test, and equivalence testing. Throughout, I use the person-level weights provided in each vintage of the NHTS (2001, 2009, 2017, and 2022). These allow me to construct 95-percent confidence intervals to detect both significant within-year differences across travel modes and within-mode differences across years. I use the survey-adjusted Pearson chi-square test to detect aggregate significant differences for all travel modes for each combination of survey years. And finally, I use equivalence testing to determine if any mode has deviated beyond a threshold I approximated as the per-year change in active travel to school (walking and biking combined) between 1969 and 2001.

3.6.2. Policy Design Analysis

I analyze the policy design of state and California school districts in three steps. First, I present descriptive statistics across the relevant policy attributes. For the state policy analysis, these are service mandates, funding formulas, user fees, and district-to-family reimbursements. For California, these are service offerings and service eligibility thresholds. Second, I display these spatially on maps. And third, I construct a binary logistic regression model for each policy attribute. Each of these models take roughly the same form, as shown in Equation 1.

$$f(p,i) = \beta + G_i + F_i + P_i + S_i + N_i \qquad \textbf{(Equation 1)}$$

where: $f(p, i)$ = outcome (the probability that state/district i has policy p)

G_i = vector of geographic characteristics for geography

F_i = vector of fiscal capacity characteristics

P_i = vector of political ideology characteristics

S_i = vector of socio-demographic characteristics

N_i = vector of neighboring state/district policies

After each model, I estimate predicted probabilities for each outcome variable across the key policy determinants present in the models at various quantities.

Additionally, in California I estimate a linear regression model to predict the eligibility thresholds in miles from home to school for districts that do provide transportation service and have an eligibility threshold. The parameters are the same as those in Equation 1. I initially considered a hurdle for this analysis, with step one being the logit explaining which districts have service and step two being how many miles a student must live from school to be eligible. However, data collection efforts revealed that many districts simply publish set routes and allow students to ride the school bus if they so choose. Because this is not a policy that guarantees transportation based on distance, I classify these districts as offering transportation but exclude them from the eligibility distance model.

3.6.3. Travel Mode Choice

For both the U.S. and California travel mode choice analyses, I first describe the data using summary statistics, including travel mode choice disaggregated by time and direction (AM trips to school and PM trips from school), the major policy variable, and for California the school choice variable. Then, I use discrete choice modeling to predict travel mode choice on school trips. I estimate multinomial logistic (MNL) regression models to explain mode choice across the 50 U.S. states and across the sample of California school districts. For each model, I assume that students and their caregivers chose the student's travel mode to maximize utility. Within each model, I use Wald tests to test for overall significance of categorical variables. The general model form is shown in Equation 2.

$$f(m, i) = \beta + C_i + H_i + T_i + N_i + S_i + D_i + G_i \qquad \textbf{(Equation 2)}$$

where: $f(m, i)$ = outcome (the probability that student i chooses mode m)

C_i = vector of characteristics for the student

H_i = vector of characteristics of the household/caregivers

T_i = vector of transportation resources

N_i = vector of neighborhood and built environment characteristics

S_i = vector of school characteristics

D_i = vector of district characteristics

G_i = vector of school transportation policies/options for the relevant state/district

This model form and collection of explanatory variables builds on my earlier paper that predicted school bus use in Georgia among bus-eligible students (Speroni, 2023). That model draws from variables previously identified in the literature—largely advanced by McDonald et al. (2008, 2011, 2022)—that were available to me in the non-confidential NHTS Georgia Add-On sample.

For both the national and California models, I cluster standard errors by student. Because the unit of analysis is the school trip, nearly all students (96%) appear twice in the model—all predictors other than the outcome travel mode and the trip time are the same for both trips. As a robustness check, I also re-run each model with standard errors clustered by state (for the national model) or district (for the California model), because the variables of interest are state- and district-level variables. These variables are not monoliths across governmental units. The transportation eligibility variable in both models can be thought of as student *exposure* to those policies. Nationally, 70 percent of students live in states with varying school transportation policies depending on home-to-school distance. In the sample of California districts, 80 percent of students live in districts with transportation policies that vary by age, school choice program, and/or home-to-school distance—the remaining 20 percent live in districts that offer no transportation to any students. Additionally, I used the Hausman-McFadden diagnostic test for both mode choice models to confirm that the independence of irrelevant alternatives assumption holds (although these tests are only feasible on unweighted models without clustered standard errors).

There are three differences between the U.S. and California analyses: the dependent variable categories, the number of models, and the use of weights.

First, for the U.S. model, I use the six transportation modes shown in Table 5, with travel via the family automobile with *only* household members as the reference outcome, because it is the most popular mode. The other modes are carpool including at least one non-family member, school bus, walking, biking, and public transit. For the California model, I calculate descriptive statistics using all six modes, but for the model, the smaller sample requires me to combine and restrict the mode options. First, I combine the automobile modes (in-household and carpool); this is again the reference outcome. Second, I combine the active modes (walking and biking). And third, I eliminate public transit; MNL models are limited by their smallest logit, and in this case, there are only 74 transit trips total. While carpooling can be conceptually folded into automobile use and biking can be folded into walking as active travel, public transit buses are fundamentally different from school buses, so I cannot combine these modes.

Second, the U.S. mode choice analysis includes only one model, but for the California analysis I estimate three models. The first model includes only NHTS data (5,111 trips). The second model includes NHTS data and the type of school program the student attends: zone public school, choice public school, or private school (4,362 trips). While the results of these models are relevant, they do not feature the variable of interest: district transportation policy/offerings. Thus, I summarize the results in text but include the results only in Appendix B. The final model form includes the vectors of school and district characteristics and the vector of school transportation options. Because these are confined to public school students—public school transportation programs are not intended for private school students in California—I exclude all private school students. And because I only have a sample of school districts in California, I exclude the students for whom I do not have district transportation eligibility data. This model analyzes 1,941 trips.

Third, the analyses differ in my use of weights. The NHTS person-level weights included with the survey data simultaneously correct for non-response and adjust to create population estimates. In the U.S. model, I employ the weights—which is a deviation from prior literature. The consensus among prior school transportation research using NHTS data has been that the weights are appropriate to use for descriptive statistics. Past publications have not employed the survey weights for their models (Kontou et al., 2020; McDonald et al., 2011), which was feasible because the samples they used were not stratified on the dependent variable (travel mode) or any variables of interest, and because the model covariates largely controlled for potential sources of non-response bias. However, because the NHTS data contain a disproportionate number of households—and thus trip observations—from the ten add-on sample states, I use the survey weights in this analysis's multinomial logistic regression to correct for a disproportionate number of trips occurring in just a few states—and, in turn, just a few policy environments—like California, Georgia, and Texas. In the California model, I do not use these weights, because the school district sample restricts the NHTS sample, rendering the NHTS weights inaccurate. In describing the results of the California model, I describe the results in the context of *trips taken by students living in the sample of districts*, rather than students in California.

After estimating the U.S. model and the final form of the California model, I calculate predicted probabilities of each travel mode across the two key policy variables. In doing so I investigate to what degree state and district policies about school bus eligibility and user fees shift the predicted probability for traveling to/from school via various travel modes, with a focus on the factors associated with less reliance on parent chauffeurs and the family automobile. As I describe in the literature review (Chapter 2), reducing automobile use for school trips has positive benefits for family time use, traffic congestion, and environmental externalities.

Part 2: U.S. State School Transportation Policies and Travel Behaviors

4. School Travel Behavior in the 21st Century

The next three chapters examine the landscape of school transportation in the United States from 2001 through 2022. First, in this chapter I examine whether and how school travel has continued to evolve in the first decades of the 21st century as it had been in the late 20th century, and in particular I explore school travel effects of the COVID-19 pandemic given the dramatic effects it had on schooling broadly. In the two chapters that follow, I use 2017 data (because they are much richer in detail than the more-recent 2022 data) to investigate the state school transportation policies in each of the 50 states and consider how these policies relate to students' travel mode choices, controlling for several relevant groups of factors. The latter analysis—which comprises Chapter 6—rests on the assumption that 2017 data are still relevant; the current chapter tests this assumption.

4.1. Context and Analytical Approach

The story of changing school travel in the latter half of the Twentieth Century is clear: families dropped walking and biking to school in favor of their cars, in droves (McDonald et al., 2011). And this has been the basis—if not the focal point—of nearly every scholarly publication on this topic for the past 25 years.

But has this trend persisted since? Have students continued to walk and bike less and less and ride in cars more and more? This chapter answers this question and additionally addresses one of the main data limitations of the rest of this dissertation: data relevancy. Namely, in Chapters 6 and 8 I rely on data that were collected a decade ago. As I explained in Chapter 3, while the 2022 NHTS data are much newer, they provide a substantially smaller sample and less overall detail than the 2017 data. In particular, the 2022 data do not include the student's state of residence, which is what allows me to individualize how state policies applied to each student. This makes the 2017 NHTS data the most recent data with which this state policy analysis is possible. Although it is common practice in travel behavior research to use survey data collected a few years in the past, the data I use for the other chapters are a decade old and that decade included the COVID-19 pandemic, so it is important to understand the extent to which children's recent travel patterns differ from those in 2017.

Personal and commercial travel broadly changed between the years leading into and the years since the pandemic. In fact, it changed…*a lot*. In short, as my co-authors and I wrote in the *Journal of the American Planning Association*, American adults are "going nowhere faster" by spending substantially more time at home and less time traveling (Morris et al., 2024). U.S. adults had a 16-percent reduction in out-of-home time and spent 17-percent fewer minutes on travel in 2023 compared with 2019. Although vehicle miles traveled (VMT) mostly recovered during the pandemic, public transit ridership cratered. And although the travel trends data cited here focused on adults, children's activities and mobilities typically are reliant upon and constrained by adults. These trends are not pandemic-induced anomalies; the time Americans spent on travel and on out-of-home activities has been steadily declining since 2003 (Morris et al., 2023). If these "going nowhere" trends were to hold for children, it could raise the possibility that the 2017 travel survey data could be meaningfully out-of-date, especially if school bus ridership trends mirrored the halting downward trend of public transit ridership over the past two decades. This possibility motivates the investigation in this chapter and highlights the importance of documenting recent changes in school travel.

Given these trends, I hypothesize that school travel also changed after the pandemic. Specifically, I hypothesize that, like personal travel broadly, the use of automobiles for school travel increased in share, while school bus ridership correspondingly declined. Three key reasons support this proposition, and all three are pandemic-related. First, with adults having more flexibility in work and commute schedules due to the rise in remote and hybrid work (Barrero et al., 2023), parents may be more likely to pick up and/or drop off their students than prior to the pandemic when that was not a feasible option for parents then confined to on-site work. Second, the pandemic had an exogenous effect on travel. The Theory of Repeated Behavior suggests that individuals repeat routine behaviors without reconsidering, but external stimuli can prompt an individual to consciously deviate from their customary behavior (Ronis et al., 1989;

Wilmot & de Lapparent, 2009). I hypothesize that many parents chose to pull their children from school buses to avoid potential viral infection during the pandemic, and that at least a sizable portion of those parents chose to continue with the newer behavior even as the pandemic receded. Finally, third, school districts across the United States have faced school bus driver shortages for about a decade, and those shortages only became more serious during the pandemic. School districts used a variety of means to adapt to these shortages, including combining and eliminating bus routes—both of which would degrade service and make the school bus a less attractive option to families with other alternatives (Carey & Phillips, 2025).

To investigate such potential changes in school travel, I use repeated cross-sectional analysis to calculate the travel day mode share for all school trips in each of the four most recent iterations of the National Household Travel Survey: 2001, 2009, 2017, and 2022.[20] Although the travel modes the surveys offered to respondents as options differed slightly year-to-year, the principal modes—in-household automobile, carpool, school bus, walking, biking, and public transit—remained the same. I place all other modes into the catch-all "other" category, but because the mix of these modes is so substantial and their collective percentage of all trips is so small, I do not interpret these results. I employ the person weights provided with each of the datasets and apply them to cross-tabulations of travel mode choice, with disaggregation for time/direction (AM to school, PM from school) and school level (elementary, middle, and high school). The sample sizes for each year after defining school trips (as explained in Section 3.5.2) are, respectively: 25,179, 39,528, 32,133, and 1,617.[21]

To test for statistically significant differences between these estimates across years and across the time/direction and school level categories, I also estimate 95-percent confidence intervals for each

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[20] These are the *only* four iterations of the NHTS thus far. Prior to 2001, FHWA termed it the Nationwide Personal Transportation Survey (NPTS), with different unit of analysis and sampling procedures.

[21] The 2022 NHTS sample size is much smaller than the prior three iterations, which is a limitation of this analysis. The FHWA has transitioned to a different target sample size and production calendar for the NHTS. Still, the 2022 NHTS sample offers over 1,600 school trips, enough to capture approximate mode share and indicate any substantial deviations from the pre-pandemic norms.

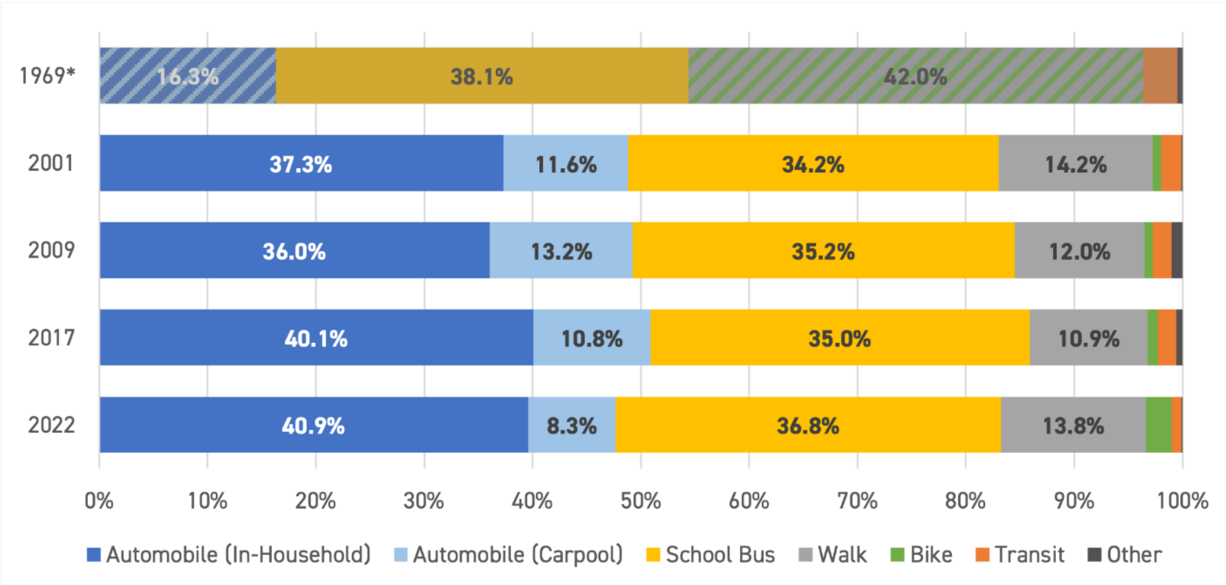
proportion. Then, I use a weighted Pearson chi-square test, which detects overall significance of the year variable across all modes. Finally, I use equivalence testing to determine whether the observed changes were statistically smaller than a threshold equal to the average annual change in automobile mode share from 1969 to 2001.

4.2. Findings

The results paint a very different picture than what I hypothesized. School travel may be the only facet of transportation to *not* change much from pre-COVID averages. Trends reveal remarkably similar mode splits for trips to and from school across the four survey years.[22] Figure 5 shows the mode shares descriptively from the 2001, 2009, 2017, and 2022 vintages of the NHTS for children ages 5–17 from the respective surveys' trip data. It also includes estimates from the 1969 Nationwide Personal Transportation Survey (NPTS) (Beschen, 1972), as a reference point to illustrate how much change there was in the three decades prior to the two decades I analyze here. My estimates reveal little modal variation survey-year-over-survey-year, particularly if one views the two automobile categories (in-household and carpool) together. In all, none of the school travel modes descriptively shifted by more than four percentage points from 2001 to 2022.

[22] "Mode split" is the term that transportation analysts use to describe the proportional distribution of a given set of travelers across various travel modes (driver, vehicle passenger, public transit, bike, walk, etc.) for a given type of trip.

Figure 5: U.S. school trip mode splits, 1969 & 2001–2022



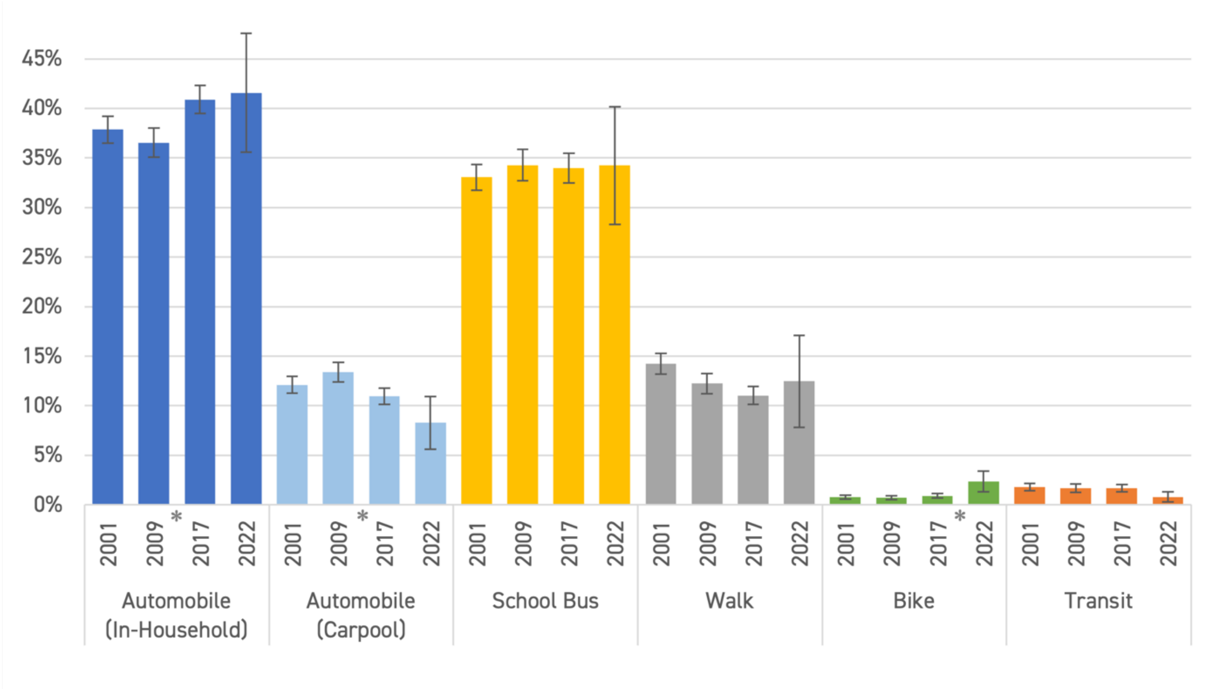
Value labels suppressed for values < 3%.
Data Source: *NPTS 1969 via Beschen (1972), NHTS 2001, 2009, 2017, 2022

The relative lack of change during the 21st century apparent in Figure 5—and in stark contrast to the dramatic change from 1969 to 2001—is supported by tests of statistical significance. I estimate 95-percent confidence intervals around each mode share estimate to assess whether observed differences are statistically distinguishable across survey years. These are shown in Figure 6.[23] There are 18 possible relationships across the modes (e.g., school bus between 2009 and 2017 was one relationship), and of these, only *three* differ by statistically significant amounts. First, the 4.1-percentage point jump in automobile share between 2009 and 2017 is a significant increase. Second, the decrease in carpooling over the same time period is significant. Finally, bicycle use significantly increased from 2017 to 2022. However, biking remains a tiny share of all trips; its percentage-point change shifted by just 1.4, from 0.9

[23] While the confidence intervals from 2001, 2009, and 2017 are relatively consistent, those from 2022 are much larger because of the smaller sample size. These larger confidence intervals make determining significant changes in 2022 more difficult, but not impossible.

percent in 2017 to still only 2.3 percent in 2022. All 15 other relationships were not statistically significant.

Figure 6: U.S. school trip mode share with confidence intervals, 2001–2022



The findings raise additional questions. First, was there a significant difference in the shares of the travel modes *overall* between the years? To examine this, I constructed a Pearson chi-square test with survey weights applied, for each combination of years to detect differences. Table 6 shows the results for each combination of survey year difference. The results indicate that school travel mode distributions overall differed significantly from 2001 to 2009, from 2001 to 2017, from 2009 to 2017, and from 2009 to 2022. However, the results do not reveal significant differences between 2001 and 2022—the length of the study period—and between 2017 and 2022, the period that included the pandemic. Additionally, the substantive magnitude of the differences in these distributions, as I explained above, is modest.

Table 6: Survey-adjusted chi-square tests of school travel mode distributions, NHTS survey year combinations

	Beginning Year					
	2001		2009		2017	
Ending Year	**Adj. *F***	***p***	**Adj. *F***	***p***	**Adj. *F***	***p***
2009	7.961	<0.001 ***				
2017	6.865	<0.001 ***	4.802	0.001 **		
2022	1.806	0.121	2.523	0.032 *	1.271	0.278

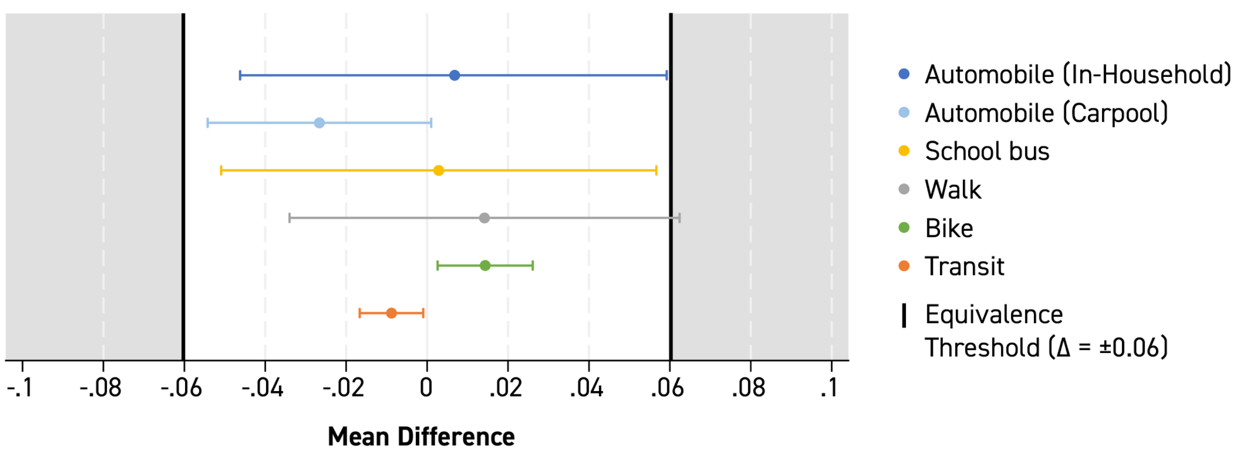
F values are adjusted for survey design.

While the chi-square results (Table 6) suggest rejecting *exact* equality between several survey years, it is not clear to what *extent* these results are different. Descriptive statistics reveal that there has been little change in school travel mode share. The larger confidence intervals in 2022 make it especially difficult to detect change. Rather than asking if they are different, instead I now turn to asking: How similar are these distributions from survey year to survey year? To answer this, I use equivalence tests. Equivalence testing is an interval testing approach that provides significant evidence that statistical relationships are beneath practically negligible effect sizes (Fitzgerald, 2025; Lakens, 2017). It also guards against Type II errors—false negatives.

Equivalence testing evaluates whether changes in a given relationship between two time periods exceed a threshold set theoretically by the researcher. For my analysis, I derive this threshold by estimating the yearly change in school travel from 1969 to 2001. In other words, I want to know if these changes that the chi-square tests detected (or did not detect for the 2022-related results due to 2022 NHTS sample size issues) exceed past dramatic changes, which when considered by the year might not seem so dramatic. From 1969 to 2001, the share of students in automobiles (in-household and carpooling combined) rose from 12.2 to 48.9, or 1.2 percentage points per individual year. To suggest with 95-percent certainty that the trends between 2017 and 2022 do *not* amount to those of the past, I set the equivalence threshold for the analysis to 1.2 multiplied by the number of years between surveys. For example, this is 0.06—six percentage points—for 2017 to 2022, represented by the thick black vertical bars in Figure 7.

I conducted equivalence tests for each pair of years from Table 6. These tests yielded results for six-year pairs (2001–2009, 2001–2017, 2001–2022, 2009–2017, 2009–2022, and 2017–2022) and an estimate for each of the six travel modes for each year—36 equivalence tests in total. And across all of those, only one result was statistically significant: Walking between 2017 and 2022 exceeded the threshold by just 0.002, which is perhaps more a function of the small sample size in 2022 than meaningful change across the years. I show the results of the 2017–2022 test in Figure 7. All six estimated mean differences cluster within 0.03 of zero, with the other five modes falling completely within the equivalence threshold. Additionally, while both biking and public transit fall fully within the equivalence threshold, biking's interval is fully above zero and transit's interval is fully below zero, meaning that for both modes the changes were statistically significant, but modest and less than the average yearly change of the past.

Figure 7: Equivalence test results, school travel mode differences between 2017 and 2022



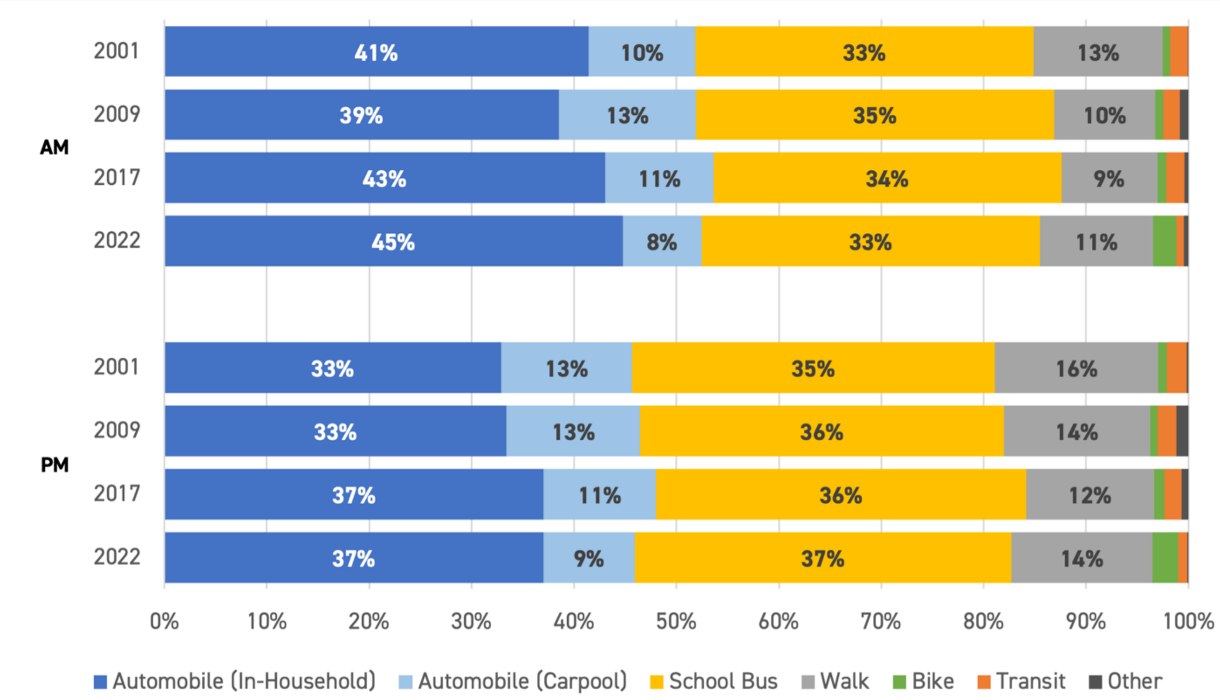
In sum, there are minor differences between these four survey years for school travel; however, the differences are small, and by most tests—and in descriptive comparisons—the proportion of students using each principal school travel mode from 2001 to 2022 changed little. While these findings are limited by the smaller 2022 sample, the evidence presented certainly does not fit my hypothesized decline in school bus use after the pandemic. Next, I explore school travel mode share differences when considering time/direction of school trips and trips taken by different ages of students.

4.2.1. Morning and Afternoon Trips

The relative lack of mode share change in the 21st century described holds when disaggregating morning and afternoon trips. Figure 8 shows point estimates graphically. To identify significantly different relationships between either AM and PM trips or between AM or PM trips survey-year to survey-year, I again estimated 95-percent confidence intervals for each proportion, shown in Table 7. Significance between AM and PM trips is shown using < and > in the table.

Across all three large survey years (2001, 2009, and 2017), students were significantly more likely to be driven or drive to school in the morning than in the afternoon, by between five and eight percentage points; perhaps accordingly, students were more likely to walk in the afternoons, by between three and four percentage points. I expect that these differences did not meet significance thresholds in 2022 again due only to the much smaller sample size in this survey, as the descriptive pattern roughly follows that of prior years. Additionally, although the proportions of students traveling via school bus were slightly higher in the afternoons, they were not significantly different than the mornings in any of the survey years.

Figure 8: U.S. school trip mode share by time/direction, 2001–2022



Value labels suppressed for values < 3%.
Data Source: NHTS 2001, 2009, 2017, 2022

While the overall theme of these results is again minimal change during this century, they do reveal a few nuanced changes. In Table 7, the up arrows indicate a significant increase from the survey year prior, while down arrows indicate a significant decrease. Notably, the afternoon was more stable than the morning. For morning trips, automobile use increased by 4.5 percentage points from 2009 to 2017; carpooling increased three percentage points from 2001 to 2009 but then dropped back down to original 2001 levels by 2017; walking decreased from 2001 to 2009 by just under three percentage points; and biking increased by 1.5 percentage points from 2017 to 2022. In the afternoon, the change in only one relationship was significant—a four-percentage-point increase in students using (in-household) automobiles from 2009 to 2017. This finding suggests that the changes detected in the earlier aggregated analyses were driven largely by morning travel.

Table 7: Proportions of school travel modes by time/direction, 2001–2022

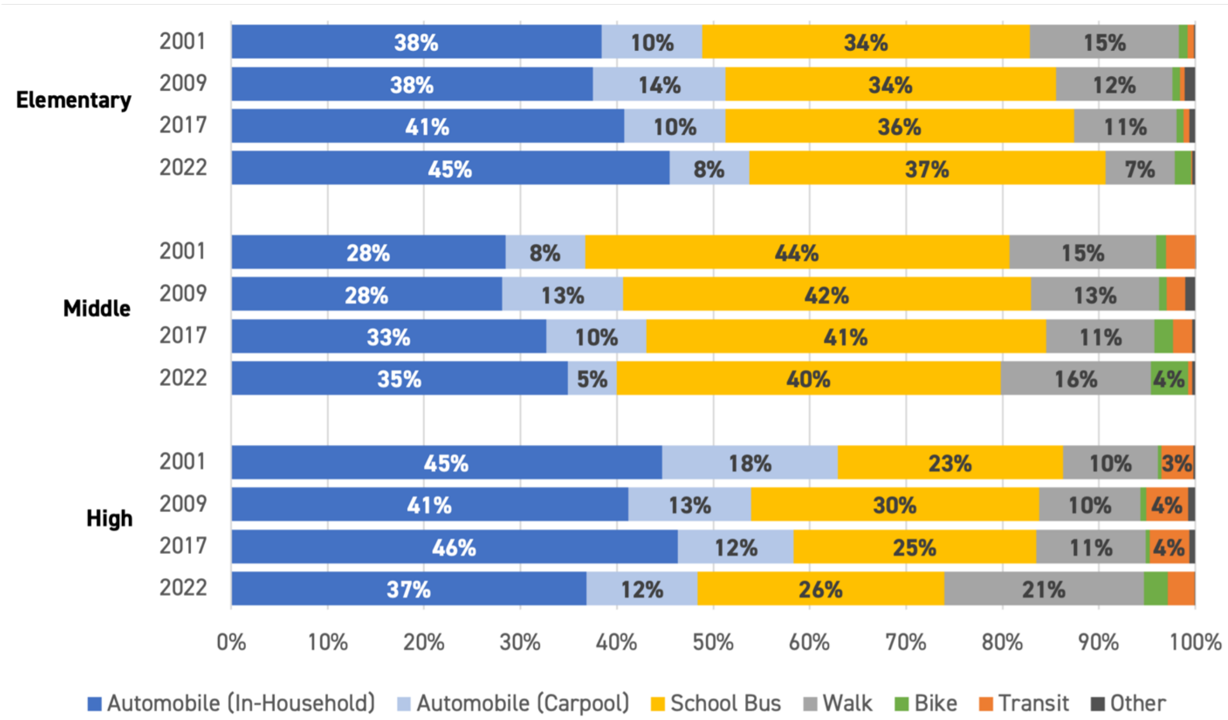
		AM to School					PM from School			
			95% CI					95% CI		
Mode	Year	Prop.	Low	High			Prop.	Low	High	
Automobile (In-Household)	2001	0.414	0.399	0.430		>	0.329	0.313	0.345	
	2009	0.385	0.368	0.403		>	0.334	0.317	0.352	
	2017	0.430	0.414	0.447	▲	>	0.370	0.354	0.387	▲
	2022	0.448	0.384	0.513			0.370	0.309	0.436	
Automobile (Carpool)	2001	0.104	0.095	0.114		<	0.128	0.118	0.139	
	2009	0.134	0.122	0.147	▲		0.131	0.118	0.144	
	2017	0.106	0.097	0.116	▼		0.110	0.100	0.121	
	2022	0.077	0.049	0.118			0.089	0.060	0.131	
School Bus	2001	0.331	0.316	0.345			0.354	0.339	0.370	
	2009	0.350	0.332	0.368			0.355	0.338	0.373	
	2017	0.340	0.323	0.356			0.361	0.344	0.378	
	2022	0.330	0.270	0.397			0.367	0.305	0.435	
Walk	2001	0.126	0.115	0.138		<	0.160	0.147	0.173	
	2009	0.099	0.089	0.110	▼	<	0.143	0.130	0.156	
	2017	0.094	0.084	0.104		<	0.125	0.113	0.137	
	2022	0.110	0.065	0.182			0.138	0.087	0.211	
Bike	2001	0.007	0.005	0.010			0.008	0.006	0.012	
	2009	0.008	0.006	0.010			0.007	0.006	0.010	
	2017	0.008	0.006	0.011			0.010	0.008	0.014	
	2022	0.023	0.013	0.042	▲		0.025	0.014	0.044	
Public Transit	2001	0.017	0.013	0.022			0.020	0.015	0.025	
	2009	0.016	0.012	0.021			0.018	0.014	0.024	
	2017	0.018	0.014	0.023			0.017	0.013	0.021	
	2022	0.007	0.002	0.024			0.009	0.003	0.025	

Significant differences:
▲ = *Increase* from prior survey year
▼ = D*ecrease* from prior survey year
< = AM greater than PM
> = PM greater than AM

4.2.2. School Grade Level Differences

There is a bit more modal variation when I disaggregate the data by student age. Figure 9 shows the mode shares across the three principal school-age levels: elementary (ages 5-11), middle (ages 12-14) and high (ages 15-18). Similarly to the morning and afternoon trips, I estimate confidence intervals for the different school levels to discern any significant differences across the levels and years. The results are shown in Table 8.

Figure 9: U.S. school trip mode share by school-age level, 2001–2022



Value labels suppressed for values < 3%.
Data Source: NHTS 2001, 2009, 2017, 2022

Thematically, middle school students—who are generally old enough to walk to school unescorted but too young to drive—tend to rely on the school bus more and rely less on walking and in-household automobiles than do both elementary and high school students. These differences are substantial, too. For example, in 2017, the share of middle school students using the school bus was 16 percentage points higher than it was for high schoolers, which exceeds either group's cumulative share of walking, biking, and transit combined. High school students are the champions of public transit, though the shares remain small at four percent or less. Survey-year to survey-year, I again observe only minimal changes. Carpool use from 2001 to 2009 increased for elementary and middle school students but decreased substantially for high school students. The biking increase I detected in the overall analysis for all times and school levels appears driven largely by high school students. And despite the seemingly sizable changes in descriptive shares for walking, the differences are not significant.

Table 8: Proportions of school travel modes by student school level, 2001–2022

		Elementary					Middle					High			
			95% CI					95% CI					95% CI		
Mode	**Year**	**Prop.**	**Low**	**High**			**Prop.**	**Low**	**High**			**Prop.**	**Low**	**High**	
Automobile (In-Household)	2001	0.388	0.370	0.407		>	0.293	0.267	0.319		<	0.450	0.421	0.479	
	2009	0.378	0.358	0.399		>	0.284	0.259	0.311		<	0.421	0.387	0.456	
	2017	0.415	0.395	0.435		>	0.338	0.313	0.365	▲	<	0.468	0.439	0.498	
	2022	0.459	0.368	0.553			0.357	0.279	0.442			0.380	0.268	0.505	
Automobile (Carpool)	2001	0.108	0.097	0.120			0.085	0.071	0.102		<	0.191	0.170	0.214	
	2009	0.138	0.122	0.155	▲		0.128	0.111	0.148	▲		0.132	0.117	0.149	▼
	2017	0.106	0.094	0.118	▼		0.105	0.090	0.122			0.123	0.107	0.142	
	2022	0.082	0.049	0.133			0.052	0.030	0.090	▼		0.113	0.049	0.241	
School Bus	2001	0.332	0.314	0.351		<	0.430	0.402	0.458		>	0.218	0.195	0.244	
	2009	0.337	0.316	0.359		<	0.414	0.383	0.445		>	0.283	0.248	0.321	▲
	2017	0.353	0.332	0.375			0.402	0.372	0.433		>	0.241	0.215	0.269	
	2022	0.365	0.275	0.466			0.390	0.296	0.494			0.249	0.168	0.352	
Walk	2001	0.155	0.140	0.171			0.153	0.133	0.176		>	0.102	0.084	0.123	
	2009	0.123	0.108	0.139	▼		0.137	0.118	0.158			0.107	0.089	0.129	
	2017	0.107	0.094	0.121			0.112	0.094	0.134			0.117	0.099	0.138	
	2022	0.072	0.046	0.111			0.155	0.101	0.233			0.206	0.075	0.454	
Bike	2001	0.008	0.006	0.013			0.010	0.006	0.018			0.003	0.001	0.008	
	2009	0.008	0.005	0.012			0.008	0.005	0.012			0.006	0.004	0.010	
	2017	0.007	0.005	0.010		<	0.019	0.012	0.030		>	0.004	0.003	0.007	
	2022	0.016	0.008	0.034			0.038	0.013	0.109			0.024	0.007	0.081	▲
Public Transit	2001	0.007	0.005	0.010		<	0.029	0.018	0.045			0.034	0.024	0.046	
	2009	0.005	0.003	0.009		<	0.018	0.013	0.026		<	0.042	0.028	0.064	
	2017	0.006	0.004	0.010		<	0.020	0.014	0.028			0.039	0.028	0.056	
	2022	0.001	0.000	0.005			0.004	0.001	0.015			0.026	0.007	0.092	

Significant differences:
▲ = *Increase* from prior survey year
▼ = D*ecrease* from prior survey year
< = AM greater than PM
> = PM greater than AM

4.3. Discussion and Conclusion

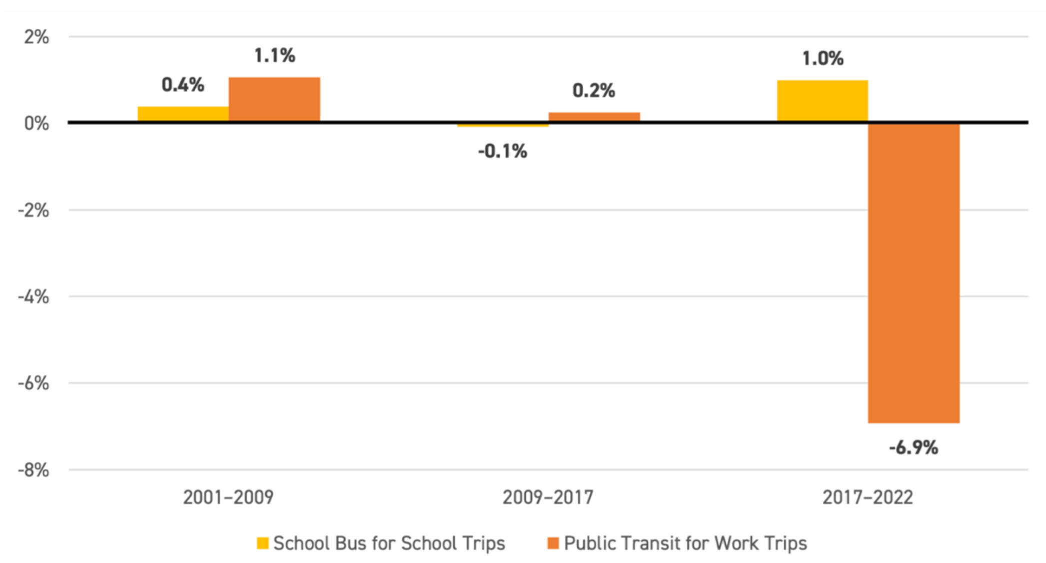
Despite a growing body of research finding extraordinary changes in adult travel behavior in the past decade and despite an older body of research finding extraordinary changes in school commute travel behavior in the last part of the 20th century, school commute travel behavior in the 21st Century has held remarkably steady. This finding is a departure from the 1970s, 1980s, and 1990s trends of less walking and biking and more driving and being driven. It is even possible that walking and biking have begun to recover among middle- and high-school-aged students, although the observed trends are modest and I am not confident enough to consider these to be trends until additional post-pandemic school commute travel data become available.

Prior to the pandemic, there was only one significant, uniform change in school travel across all times of day and ages: from 2001 to 2009, automobile use (with household members only) decreased while carpooling (with at least one non-household member) increased. I do not examine the possible causes of this shift here, but I suspect it may be due to the Great Recession. In 2009, families may have either looked to save money on fuel expenses by combining school chauffeuring trips with other families, or they may have faced more inconsistent automobile access amid the financial uncertainty. The unemployment rate during this era nearly doubled (U.S. Bureau of Labor Statistics, 2012), meaning more parents/caregivers were idle, which could explain why families opted for carpooling over the school bus. While future research could explore this question, the relative change in automobile (in-household) use and carpooling between 2001 and 2009 was still small, and the shares of carpooling versus in-household driving snapped back by 2017. Further, none of these differences were significant in a robustness check wherein I combined both automobile modes (in-household and carpooling) into one category.

Amidst all these changes and nuance, one constant from the 1970s through 2020s stands out: the school bus. The relative share of students using the school bus has changed remarkably little over the past half-century, even during the 1970s–1990s era of dramatic changes in the relative amounts of walking/biking and car use. Year in and year out, and decade in and decade out, just over a third of students board the iconic yellow vehicles each school day.

What makes the collective lack of change in school travel over the past 25 years even more remarkable is that the period from 2017 to 2022 was one of *dramatic* changes in travel patterns. This was especially true for fixed-use, fixed-schedule public transit—which is arguably the closest corollary to children commuting by school bus. People left public transit because of shifting commute patterns stemming from pandemic-related increases in remote work, fears of viral infections, and increased automobile travel (Q. He et al., 2022; Osorio et al., 2022; Parker et al., 2021). In 2017, 5.2 percent of adults regularly commuted to work via public buses and trains; in 2022, that had fallen to just 3.4 percent. This trend diverges notably from the analogous pattern of school bus use. Figure 10 shows the percentage change for both school bus mode share among school trips and public transit mode share among work commute trips across the three change periods: 2001 to 2009, 2009 to 2017, and 2017 to 2022. In short, while public transit use increased slightly in the first two periods, the use of public buses and trains *cratered* in the pandemic. Use of the school bus, in contrast, remained level, with even a modest increase.

Figure 10: Percentage change per year in U.S. school bus and public transit mode share for school/work commute trips, 2001–2022



Data Source: NHTS 2001, 2009, 2017, 2022

The overall lack of change in school travel analyzed here may be due—partially or substantially—to differences between the way we govern workplaces and the way we govern schools. On the one hand, workplaces—particularly in the private sector—are largely free to set their own working hours and work locations, including the discretion to permit at least some of their workers to work remotely if they so choose. On the other hand, school hours and locations are relatively rigid and clearly spelled out in state and local policies. Before the pandemic, the commutes between home and work and home and school were similar in many ways—these daily trips serve to fulfill an individual's primary obligations outside the home and thus often take top priority in scheduling. Prior to the pandemic, this meant traveling to work for most commuters (about 94% in 2019) and traveling to school for nearly all students (only 3% of students were home schooled in 2016) (National Center for Education Statistics, 2018; U.S. Census Bureau, 2019). However, during the pandemic and in the years since, workplace norms and policies around these issues changed—and in some cases have shifted again but in ways that have not reverted to pre-pandemic norms. Hours worked remotely and hybrid schedules, both those that vary location by days and by parts of days, increased roughly five-fold from 2019 to 2022 (Barrero et al., 2023). The changes in how and where adults spend their time, and how they get to those activities, followed.

Schools, however, do not generally have such flexibility, and this has not changed substantially post-pandemic. State laws generally establish K–12 schooling as an in-person enterprise by requiring "public day schools" schools to operate full instructional days and by requiring students to attend (California Department of Education, 2025b; Silva-Padron & McCann, 2023). States also impose requirements that further restrict schools' logistical flexibility, such as mandatory learning hour minimums and narrow ranges of times in which schools may begin and end their instructional days (Silva-Padron & McCann, 2023). These regulations limit the ability of schools to create similar environments for students as workplaces do for employees; remote learning and hybrid schedules are by rare exception only. Further, in many states, school districts also are required to provide school transportation to a portion of their students, meaning that even if school bus ridership waned during the pandemic, districts could not scale back their school bus operations proportionately because of state law (McDonald & Howlett, 2007) This obligation meant that when public health concerns subsided, the pre-pandemic school bus systems were still there, waiting for students to get back on board, while many general public transit systems had pivoted their service in response to a combination of funding shortfalls and changing demand, eliminating some routes and shifting away others from traditional commute-oriented service toward other, broader trip purposes (Magassy et al., 2024). And while hypothetically schools could have changed policies to adopt remote learning arrangements in line with adult remote work, there is substantial evidence that schools that held onto remote learning longer during the waning days of the COVID-19 pandemic saw significantly worse learning outcomes than schools that returned to in-person instruction sooner (Goldhaber et al., 2023; Jack et al., 2023).

In sum, school trip mode share has remained remarkably consistent in the past quarter-century—and remarkably so in the era of pandemic upheaval and its aftermath. To my knowledge, this is the first analysis of post-pandemic national data on school travel. This relative stability bucks larger post-pandemic travel behavior trends and transportation system usage. While adults fled public transit and other shared modes generally, children have continued to ride school buses. However, due in part to the rigidity of state education policies perhaps, school travel stability is not as surprising as one might imagine.

5. U.S. State Policy Design Analysis

In this chapter I begin by making the case that states are the most important institutional actors in making, enforcing, and funding school transportation policy. Because the federal government largely leaves education policy to states and because local school districts are subordinates of their states, states establish the minimum policies and funding formulas within which districts must work in providing school transportation. Drawing on the data and methods I described in Chapter 3, I lay out the U.S. school transportation policy context by describing the results of the 50-state inventory of school transportation policies. Then, I estimate a model predicting variation in state school transportation policy across three key components—state mandates for districts to provide transportation, state funding for school transportation, and state authorization for districts to charge transportation user fees—across key drivers of policy design. In the next chapter, I connect the results from this chapter to individual student trips and explain the broad range of factors that predict school travel mode choice, with a focus on the application of these policies.

5.1. Introduction to State Policy Context

Recall from the literature review in Chapter 2.4 that school transportation—as with most matters of education—is principally the purview of state governments in the United States. Within the U.S. federal system, all matters of government not addressed by the Constitution—including education—fall to the states. States, in turn, enable the creation of all lower levels of government, including counties, cities and towns, and school districts, among others. In line with this, states must first set the policies that govern what school districts must, can, and/or cannot do. This includes basic policies like instructional practices, teacher expectations, and facilities requirements, but it also includes non-instructional policies like athletics, nutrition, finance, and transportation.[24] State governments typically establish minimum requirements for districts, which districts then have the flexibility to exceed but not fall below. In transportation, this might take the form of a state establishing a minimum requirement that districts must provide transportation to all students living more than two miles from their school; districts would still be free to provide transportation within that two-mile buffer.

As of 2017 (to match with the travel survey data I use in this next chapter's analysis), each of the 50 states had school transportation legislation in some combination of their civil and/or administrative codes. And, as we will see, no one state's legislation even approximately mirrors another. These policies typically determine which students a district must transport, which students' trips are eligible for state funding support, whether districts are able to charge user fees, and whether districts can reimburse families for providing required transportation privately. The 50 state policies, taken together, govern the largest form of shared mobility in the United States: school bus transportation.

As part of this analysis, I assembled data on state policies by conducting a systematic review of the relevant statutes and administrative codes for each of the 50 states, plus the District of Columbia.[25] I relied on prior work on this topic from McDonald and Howlett (2007) to define the analytical categories for which I would evaluate each policy, and refined those categories through an initial ten-state sample before proceeding with the remaining 40 states and D.C. I discussed these categories earlier in Table 3 of Chapter 3.4.2. For all analyses in this chapter, I operationalized the policy data as of January 1, 2017,

[24] As I discuss in the literature review, although the federal role in education has increased over the past half-century, it is still relatively small, and education remains largely the purview of state governments. The federal role in school transportation has only very minimally expanded during that time, in two principal forms: ensuring vulnerable student populations (students with disabilities, students experiencing homelessness, and foster youth) receive transportation so that they can access a free appropriate public education, and an infusion of cash for the purchase of zero- and low-emission school buses as part of the 2021 Infrastructure Investment and Jobs Act.

[25] There are two cases where the state and school district are intertwined. First, while Hawai'i does have state school transportation policies, Hawai'i also has only one school district administered at the state level. So, in Hawai'i, state policy *is* local policy. Washington, D.C. is somewhat similar. D.C. Public Schools is the only school district in the District of Columbia, and it does not offer school transportation to students.

which approximates the transportation policies as they were during the 2016–2017 academic year, a time period that roughly overlaps with the 2017 NHTS data collection window.

5.2. State Policy Design: Mandates, Funding, and Fees

I investigated the contours of state policy designs by analyzing which trips were mandated for school transportation provision by the state, funding mechanisms for reimbursing school districts for providing transportation, policies about districts being permitted to or prohibited from charging transportation user fees to families, and policies about districts being permitted to or prohibited from reimbursing families for providing their own transportation in lieu of required district-provided service.

5.2.1. State Mandates for School Transportation

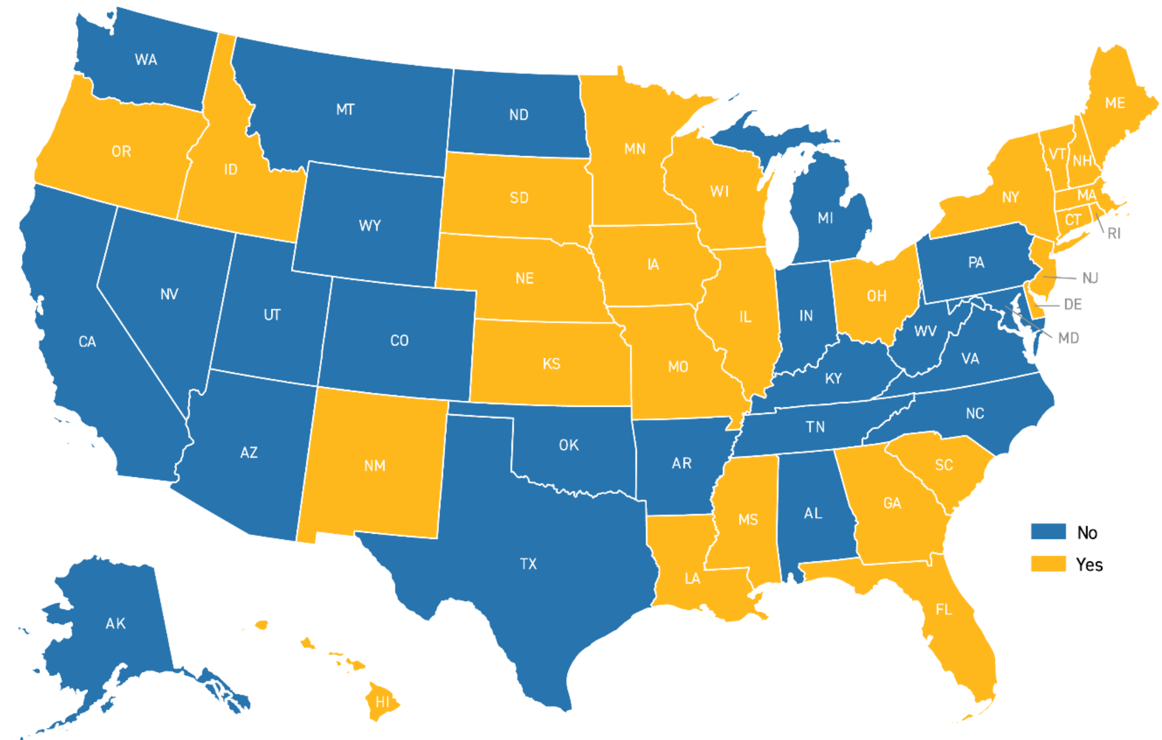
The data show substantial variation in whether and how states require school districts to provide transportation to at least some of their students who attend assigned public schools.[26] Figure 11 is a U.S. map, displaying in gold the 27 states that required school districts to provide transportation and in dark blue the 23 states that did not. On the surface, the map shows pockets of geographic consistency. For example, all six New England states required transportation, as did many of the Midwest states and southeast states; except for New Mexico, all southwestern states did not.

However, underlying this apparent uniformity among states that required school transportation were significant variations in how states determined *which* students to whom these transportation provision mandates apply. Most states used a distance threshold based on the number of miles from a student's home to their school, which often varied by the age of the student—but they did not do so uniformly. Table 9 illustrates these differences. For example, Florida and Minnesota set their eligibility thresholds at two miles across all grade levels, while New Mexico used ascending eligibility thresholds by

[26] As I mention earlier, all states must provide transportation to special populations—students with disabilities, foster youth, and students experiencing homelessness—under federal law. My evaluation of these policies does not consider these students because their treatment is relatively uniform across all 50 states.

age: one mile for kindergarten through sixth grade, 1.5 miles for grades seven through nine, and two miles for grades ten through 12. Of the 27 mandate states, none required the service be provided to all students.

Figure 11: State requirements for district-provided school transportation



Data Source: U.S. State School Transportation Policy Inventory

There were exceptions to these thresholds as well. Nine states established a requirement for providing transportation, but at least for some student ages the statutes explicitly passed the responsibility of determining service eligibility down to the local school districts. Additionally, some statutes carved out exceptions to requirements if alternative modes were available—usually for cities with robust public transit options.[27]

[27] The degree to which these transit systems are sufficiently "robust" is up for debate. New York state has different requirements for metropolitan New York City, which most certainly fits the definition for robust public transit. Whether public transit service is adequate for high school students in Milwaukee—where Wisconsin's statute has an exception for districts providing school bus service—is more open for debate.

Table 9: State required trips by distance-based eligibility thresholds across school levels, 2017 U.S.

	Miles from Home to School		
Mandate State (27)	**Elementary (K-5)**	**Middle (6-8)**	**High (9-12)**
CT	Delegated to Districts	Delegated to Districts	Delegated to Districts
DE	1.0	2.0	2.0
FL	2.0	2.0	2.0
GA	1.5	1.5	1.5
HI	1.0	1.5	1.5
ID	1.5	1.5	1.5
IL	1.5	1.5	1.5
IA	2.0	2.0	3.0
KS	2.5	2.5	2.5
LA	1.0	1.0	1.0
ME	Delegated to Districts	Delegated to Districts	Delegated to Districts
MA	2.0	No Requirement	No Requirement
MN	2.0	2.0	2.0
MS	1.0	1.0	1.0
MO	3.5	3.5	3.5
NE	4.0	4.0	4.0
NH	2.0	2.0	No Requirement
NJ	2.0	2.0	2.5
NM	1.0	1.5	2.0
NY [a]	2.0	2.0	3.0
NY [a] (NYC)	1.0	No Requirement	No Requirement
OH	2.0	2.0	No Requirement
OR	1.0	1.0	1.5
RI	Delegated to Districts	Delegated to Districts	Delegated to Districts
SC	1.5	1.5	1.5
SD	5.0	5.0	None
VT [b]	Delegated to Districts	Delegated to Districts	Delegated to Districts
WI	2.0	2.0	2.0

States without any mandates (23): AL, AK, AZ, AR, CA, CO, IN, KY, MD, MI, MT, NV, NC, ND, OK, PA, TN, TX, UT, VA, WA, WV, WY

Delegated to Districts = State codes expressly delegate districts to determine eligibility for transportation

No Requirement = No transportation mandate for the applicable age, but other ages are mandated

[a] Note: New York has two sets of regulations, one for the New York City area and one for the rest of the state.

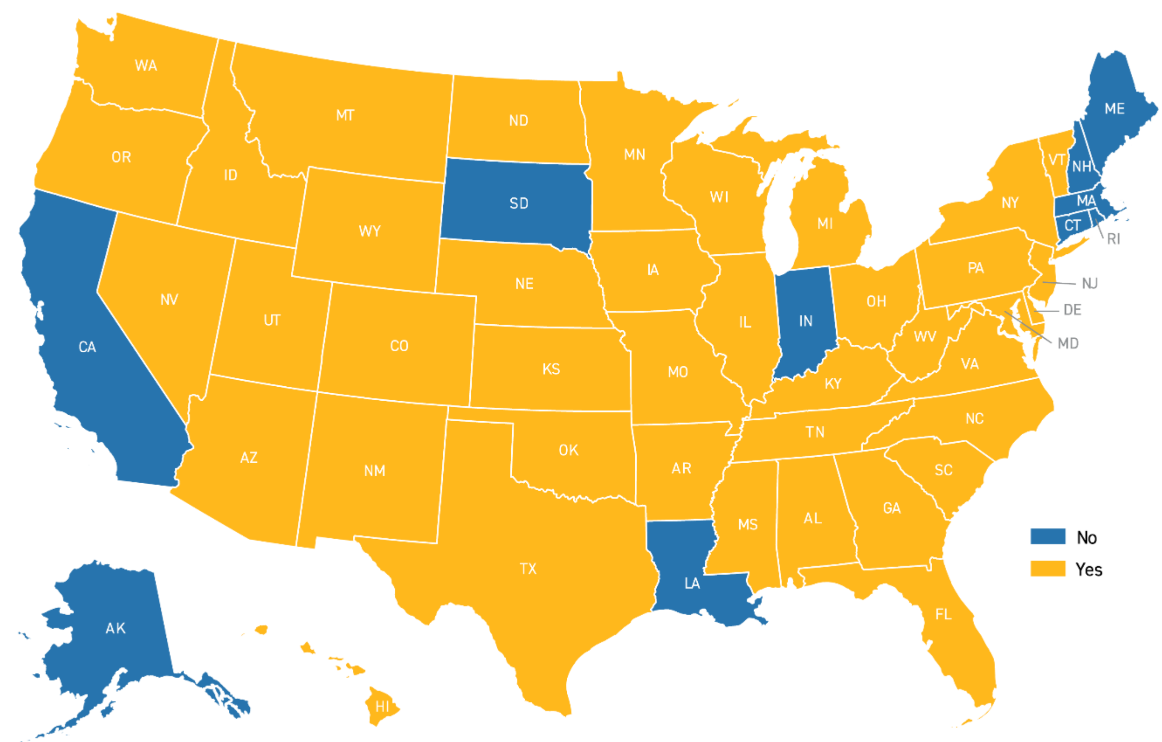
[b] Vermont does not formally require districts to provide transportation, but it does require its districts to develop a "transportation policy" and submit that policy to the state.

Source: State education statutes and administrative codes (see Appendix A for detailed list)

5.2.2. State Funding for School Transportation

The ways in which states funded school district transportation systems varied even more than the service provision requirements, although this diversity is not obvious at first glance. Figure 12 provides a high-level overview of which states had some sort of funding formula specifically for school transportation, with funding states in gold and non-funding states in dark blue. In short, all but nine states funded school transportation systems—and only four of those states without funding formulas were outside of New England.[28]

Figure 12: State funding for district-provided school transportation



Data Source: U.S. State School Transportation Policy Inventory

[28] In New England, most school districts are single-town school districts, and the shares of their education revenue from local sources are among the highest in the U.S. (Kenyon et al., 2022). So, unfunded state education mandates like these are the norm there.

While funding is relatively commonplace, the mechanisms states used to send money to school districts were not. No two states used an identical funding formula, except for those that simply did not fund transportation. (And even the ways in which states did not formulaically fund transportation varied.) Table 10 details by state the type of funding formula and the distance from home to school required for a student's trip to be state funded. The table includes two policy details: (1) the type of formula, and (2) the distance thresholds at which a student's trip becomes eligible for state funding, by school grade level.

Table 10: State school transportation funding formulas and eligibility, U.S. as of 2017

		Miles from Home to School		
State (41)	**Formula Type**	**Elementary (K-5)**	**Middle (6-8)**	**High (9-12)**
AL	Variable rate per specified unit	2.0	2.0	2.0
AK	Variable rate per specified unit	All	All	All
AZ	Flat rate per specified unit	1.0	1.0	1.5
AR	Flat rate per specified unit	All	All	All
CO	Multivariate calculation	All	All	All
DE	Multivariate calculation	1.0	2.0	2.0
FL	Multivariate calculation	2.0	2.0	2.0
GA	Multivariate calculation	1.5	1.5	1.5
HI	Single-district state program	1.0	1.5	1.5
ID	Actual or Approved Costs	1.5	1.5	1.5
IL	Actual or Approved Costs	1.5	1.5	1.5
IA	Actual costs (only high-spend districts)	2.0	2.0	3.0
KS	Area density	2.5	2.5	2.5
KY	Area density	1.0	1.0	1.0
MD*	Multivariate calculation	All	All	All
MI	Linear density	1.5	1.5	1.5
MN	Variable rate per specified unit	2.0	2.0	2.0
MS	Variable rate per specified unit	1.0	1.0	1.0
MO	Actual or Approved Costs	3.5	3.5	3.5
MT	Flat rate per specified unit	3.0	3.0	3.0
NE	*Lesser of:* Approved costs or Flat rate per specified unit	4.0	4.0	4.0
NV	Flat rate per specified unit	All	All	All
NJ	Linear density	2.0	2.0	2.5
NM	Multivariate calculation	1.0	1.5	2.0
NY	Actual or Approved Costs	2.0	2.0	3.0

State (41)	Formula Type	*Miles from Home to School* Elementary (K-5)	Middle (6-8)	High (9-12)
NC	Actual or Approved Costs	All	All	All
ND	Linear density	All	All	All
OH	*Lesser of:* Linear density or flat rate per unit	2.0	2.0	All
OK	Area density	1.5	1.5	1.5
OR	Actual or Approved Costs	1.0	1.0	1.5
PA	Multivariate calculation	1.5	1.5	2.0
SC	Actual or Approved Costs	All	All	All
TN	Linear density	1.5	1.5	1.5
TX	Linear density	2.0	2.0	2.0
UT	Actual or Approved Costs	1.5	2.0	2.0
VT	Actual or Approved Costs	All	All	All
VA	Area density	All	All	All
WA	Multivariate calculation	All	All	All
WV	Actual or Approved Costs	2.0	2.0	2.0
WI	Flat rate per specified unit	2.0	2.0	2.0
WY	Actual or Approved Costs	All	All	All

States without funding formulas (9): CA**, CT, IN, LA, ME, MA***, NH, RI, SD

All = Universal eligibility

* Maryland legislation specifically tasks counties with identifying the eligibility for school bus service; in turn, those trips that counties deem eligible are also eligible for funding.

** California did not have a formula and instead distributed the same amount of money each year to districts.

*** Massachusetts had an actual/approved cost formula but has not funded it since the early 2000s. The state sends a small amount of transportation money to multi-town districts, of which there are few.

Source: State education statutes and administrative codes (see Appendix A for detailed list)

I classify the formulas into six general types, again adapted from the framework developed by McDonald and Howlett (2007):

1. *Actual and/or approved costs:* States require districts to submit expenditure reports and receive reimbursement for some percentage of the costs associated with providing transportation.
2. *Area density:* States calculate funding by assigning a dollar amount to the result of dividing the number of transported students by the square-mile area of the district.

3. *Linear density:* States calculate funding by assigning a dollar amount to the result of dividing the number of transported students by the miles of school bus routes.
4. *Flat rate per specified unit:* States issue funding per some basic unit, such as student miles transported, vehicle miles of service, or simply per student transported.
5. *Variable rate per specified unit:* States issue funding per some basic unit, but the amount varies by the unit, for example, a per-mile amount that increases with distance.
6. *Multivariate calculation:* Some states have multivariate equations, ranging from simple to complex, to determine the amounts of funding that school districts receive.

The most common approach was an actual/approved costs formula, which 13 states used in some form. Ten states used a density formula in some form, area or linear. Eight states used multivariate equations. Two states used a combination of these formula types: Ohio and Nebraska both sent districts the lesser amount of two formulas.

These six possible approaches—plus not funding school transportation—characterized 48 of the 50 states/district in my analysis. While California (as of 2017) technically funded school transportation from its Home-to-School Transportation (HTST) Fund, the funding was not formulaic. HTST funding went to districts at the same level year after year, regardless of the transportation system districts operated. Thus, unlike all the formulas employed by other states, these California funds were not actually *tied* to transportation. As a result, California transportation funding failed to scale with student enrollment growth and did not account for expansion of school choice programs (that tend to increase average home-to-school distances), both of which add substantial costs to a school district's transportation system. I discuss this issue more in Chapter 7 when I analyze California school district transportation policies. Additionally, because the State of Hawai'i hosts just one school district, the state was thus responsible for funding the operation entirely.

As part of most funding formulas, states then determine which students' trips are eligible for these funds. In most cases and as with service mandates, these are thresholds of distance from a student's home to their school. In states that have both service mandates and funding formulas, these distances are typically the same, except for in Missouri and Vermont. But unlike with service mandates, 12 states make *all* students eligible for state funding, if the district chooses to offer transportation to them.

5.2.3. User Fees and Reimbursements

In addition to transportation funds through state sources, some states allowed districts to charge user fees to families who opt in to transportation services. For districts to be able to charge fees for transportation, state governments must first authorize them to do so. Figure 13 displays the 50-state inventory for school transportation user fee policy as a map. Fifteen states authorized districts to collect fees (light blue on the map), either explicitly as a transportation fee or through a blanket authorization for districts to charge fees for non-classroom expenses.[29] In Hawai'i, state statutes required families to pay a transportation user fee (dark blue), but this is again caveated by the single-district nature of the state. The remaining 34 states did not allow districts to charge transportation fees. Eight of these states expressly prohibited such fees in state statutes (gold on the map), while the other 26 simply did not authorize it (tan). In this instance, the absence of policy *is* policy.

Unlike with mandatory service and funded service for which states use eligibility thresholds, most states authorized or prohibited the charging of fees unilaterally. However, there were some exceptions to this norm. For example, Illinois only permitted districts to charge transportation fees for students who lived within 1.5 miles from their school—those who were not eligible for state-mandated/funded trips. New Jersey and South Dakota employed a similar approach. Maryland, which generally passed these policy decisions to its counties, expressly prohibited fees in Montgomery County but authorized them in all 22 other counties and Baltimore city.[30]

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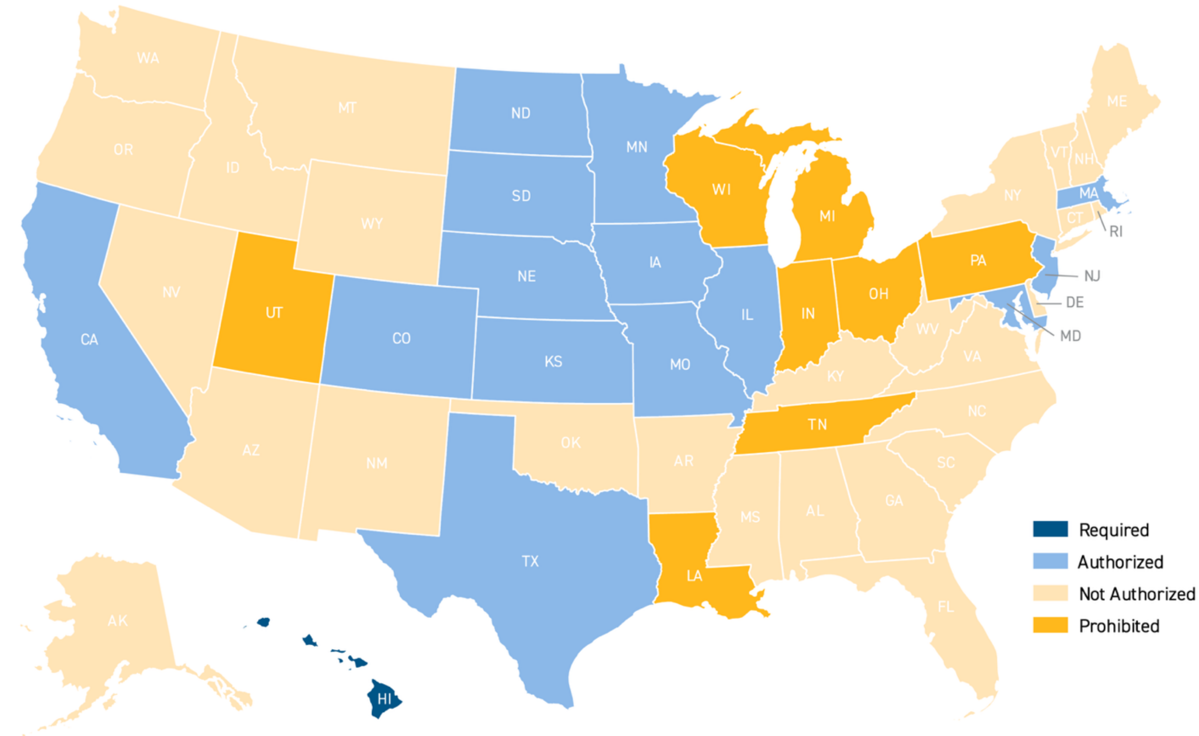
[29] In cases where states authorized fees only generally, I searched several school districts in the state to confirm that at least one was using this authorization to charge school transportation fees.

[30] In Maryland, counties and school districts are coterminous. There are 23 counties in Maryland, plus Baltimore City as an independent city.

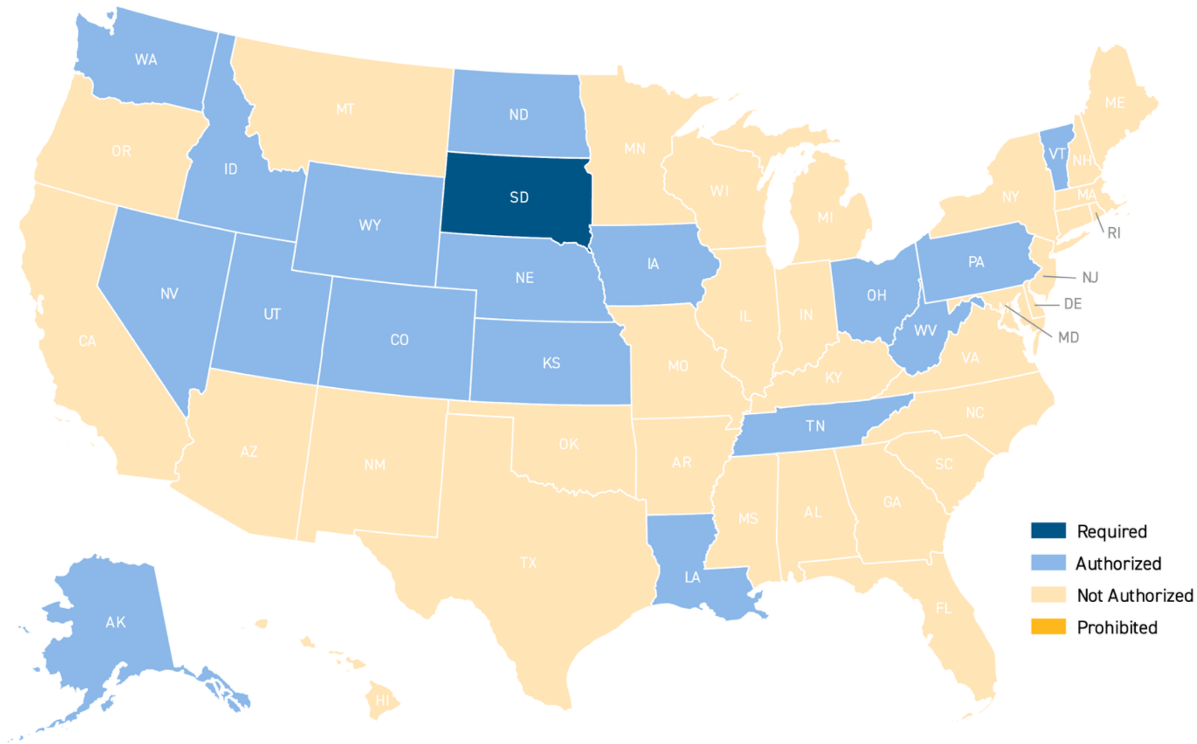
Figure 13: State policies about districts charging transportation user fees for families



Data Source: U.S. State School Transportation Policy Inventory

Some states authorized districts to reimburse parents/caregivers for providing transportation that districts would otherwise have been required to provide, shown in blue in Figure 14. These payments in lieu of transportation appeared to be largely directed at rural students and/or unilaterally across rural states, as a means of achieving some cost efficiency compared to operating school buses across wide swaths of geography to collect only a few students. This practice was common across the Great Plains and Mountain West, and was even required in South Dakota (dark blue) for students who lived outside of an incorporated municipality.

Figure 14: State policies for district payments in lieu of transportation



Data Source: U.S. State School Transportation Policy Inventory

5.2.4. Synthesizing the Policy Environment

While states appear to converge on the idea that school transportation is a matter of state education policy, they diverge substantially in how they operationalize that responsibility. The policy goals are similar: state lawmakers understand that children need a means of transportation for traveling to school if they live too far from school to walk. The policy designs by which the various state legislatures seek to achieve this vary substantially, which in turn contributes to the diversity of responsibilities that states pass down to school districts and then, in turn, to families.

This policy variation reflects varying levels of state involvement in school transportation. Some states, like Oregon, have short distance thresholds and precise funding formulas intending to cover substantial portions of the transportation costs. Others, like California and Indiana, leave the issue to local control and locally-controlled funds.[31] While most states fall on a spectrum somewhere between those two extremes, still others employ a hybrid approach. For example, Maryland has a robust funding formula that even accounts for the increased financial burden imposed by transporting special education students, but it leaves determining eligibility for school transportation entirely to its county school districts.

Across the three principal domains of state school transportation policy—mandatory trips, state funding, and user fees—there seems to be a high degree of variation in the nuances of policy, particularly around how far a student must live to have their trip be required and/or funded and around the formulas states use to fund school transportation. However, there may be more consistency as one steps back and considers not the nuances of the policies but, more broadly, whether states address these issues at all. I turn to this idea next.

5.3. Explaining State Policy Design

5.3.1. Analytical Framework

What could explain this enormous variation in school transportation policies across states? To consider the various motivations and rationales behind implementing the myriad school transportation policies described above, I consider several broad categories of explanatory factors drawn from the literature on education policy adoption, transportation finance, and policy diffusion (see Chapter 2): geography, fiscal capacity, political ideology, demographics, and inter-state diffusion. Each of these may shape how state governments evaluate the need for and costs of providing school transportation.

First, I consider the basis for implementing school transportation in the first place: students may live too far from their schools to reasonably walk. The earliest school buses were developed for rural students who lived far from their schools, especially after the consolidation movement transitioned

[31] I use the term "locally-controlled funds" here, because in many cases districts can use general state education aid to fund local transportation options. Although these are state and not local revenues, the funds are controlled locally by the school district. The funds need not be only local revenue from property taxes.

students from one-room school houses to multi-grade schools (Berger, 1979). Thus, it is possible that states with higher proportions of students living in rural areas are more likely to support school transportation, either through mandates or funding. I also considered the shares of students living in suburban areas, climate, region, public transit availability, and walkability as potential reasons for states offering or not offering school transportation.[32]

Second, school transportation is an expensive undertaking for governments. Given the myriad possible uses for limited public funds, governments with greater resources may be more likely to support school transportation. To capture this, I draw on data for states' gross domestic product (GDP) per capita in 2016 as a proxy for the possible tax revenue on which the state and its local governments could draw. I use this variable in the models for mandates and fee authorizations. To consider a state's fiscal capacity to fund transportation, I instead consider its overall expenditures on education per pupil in 2016–2017. States that spend more on education overall may be more likely to support transportation.

Third, policy uptake generally may vary depending on which political party is in control of the state legislature and governor's office. To consider that one political party may be more likely to offer more generous school transportation support, I include a measure of political ideology. States with more liberal-leaning governments may be more likely to view school transportation as an important component of educational access and therefore support greater state involvement in providing transportation. Conversely, conservative governments may place greater emphasis on local control, reduced expenditures, and greater family responsibility, all of which may lead to less comprehensive school transportation policies.

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[32] Suburban areas, climate, and walkability were all robustness checks, so I did not include them in the descriptions of the methodology in Chapter 3. To determine suburban areas, I aggregated census tract populations for each state in the suburban built environment types as defined by Voulgaris et al. (2016). For climate, I used the statewide average high temperatures from August 2016 and the statewide average low temperatures from January 2017 (Vose et al., 2017)—roughly the extremes in temperature that students would face on school commutes. Finally, for walkability, I calculated a population-weighted mean of each state's National Walkability Index across all block groups (U.S. Environmental Protection Agency, 2019).

Fourth, demographics play an important role both in the ability of families to pay user fees and in the usage of school bus service. Wealthier states may be more willing to charge user fees to families, while poorer states may be less willing to impose such a fee. Additionally, recall from the literature review in Chapter 2 that prior research suggests that school bus use varies across racial and demographic groups (S. He, 2011; McDonald et al., 2011; Speroni, 2023); it is possible that these policies are related to those differences.

Finally, state policymakers frequently look to neighboring states when adopting or modifying public policies (Karch, 2022; Saiz & Clarke, 2008). State neighbors may serve as reference points for state policymakers in determining what level of support to offer for school transportation. For example, Missouri and Kansas may look to each other to ensure that it is not offering fewer resources in its public schools, including transportation, so that Kansas City area families do not choose to move across the border for a better collection of benefits, perhaps including a free ride to school.

Together, these factors form a framework for evaluating why states employ different approaches to school transportation.

5.3.2. Limitations

This analysis has four main limitations. First, although many policy design analyses face the same limitation of an "adopt or not" outcome (Karch, 2022), the premise that policy is either a "yes" or "no" is overly simplified. As the first half of this chapter showed, state school transportation policies are complex and multi-faceted. Most states include each of the three key outcomes in different sections of their education codes. This simplistic "yes"/"no" approach captures that the outcomes are distinct but under-analyzes the nuance to each policy. Take for example state transportation funding formulas. Forty-one states have funding formulas, but they vary widely. Structuring the analysis this way yields 41 "yes" states and nine "no" states and does not capture this underlying variation. Ideally, I would use a hurdle model, wherein the first-stage logistic prediction is whether or not the state has a funding formula, and the second-stage linear prediction is the amount of transportation funding per student that states send to districts. Unfortunately, as I mention in Chapter 3, data on state transportation funding amounts are not consistently available across all 50 states.

Second, I do not have temporal data for the policy outcomes. Other studies that consider education policy diffusion typically analyze several cross-sections of time, which they use to conduct event history analyses and evaluate the time component of policy diffusion (Oliveira et al., 2023). There are many examples of such analyses about charter school legislation in the late 1900s and early 2000s (Renzulli & Roscigno, 2005; Wong & Langevin, 2007; Wong & Shen, 2002). While my analysis employs similar control variables as these studies, it does not do so over time. My study focus differs from these time series studies in two key ways. First, state school transportation policies are old; states began authorizing school districts to provide transportation in the consolidation movement of the early 20th Century (Berger, 1979; Johns, 1928).[33] For example, California's first school transportation funding came in 1950 (California Department of Education, 2021). So, these policies are often long-established. Second, these policies appear to change very little over time. I gathered the policy data for 2017, so that I could later attach them to 2017 travel survey data, but in doing so, I also checked for changes between 2017 and 2024; only California had substantial change, while a few other states made minor adjustments to their funding formulas. Given this, I suspect that a modern analysis of policy diffusion over time would be unlikely to yield much additional insight.

Third, none of the vectors of variables I include in the models consider non-policymaker parties that affect policy. In particular, these could include school district leaders—in their capacity as advocates for their schools—and trade organizations, like state associations of school transportation directors. It is possible that these organizations have a great deal of sway in adjustments to—or lack thereof—state

[33] Many (if not most) states do not have yearly digital archives of their state statutes available online. To systematically evaluate the innovation and diffusion of school transportation policies in the early 20th century would require visits to state archives. It is an ambitious but time-consuming and expensive area for future research.

school transportation policies. While I tested substituting the number of school districts per state for each of the other variables in the models, it was never statistically significant or closer to being so than the other variables. I also considered the presence of a director's association as another potential explanatory variable, but I did not view the theoretical connection to be as strong as the ones I included in the final models. Further, the small sample size of the model did not allow for additional variables.

Finally, the results of this analysis are associational and do not demonstrate causality.

5.3.3. Descriptive Statistics of Policy Design

Table 11 shows the descriptive statistics for the 50-state inventory of school transportation policies and the associated independent variables. The three outcome variables are in the top rows, shown as percentages of states who adopted the policy, reflecting the descriptive data I highlighted earlier in Chapter 5.2. I then include the descriptive statistics for each of the five other variable groups for the variables I included in the models.

Table 11 and the models that follow include two derived variables. First, I include Berry et al.'s (1998) score of government ideology for 2016 (the year in which policies governing 2016–2017 would have been established). The Berry et al. score captures the relative partisan composition of state government, including both chambers of the legislature, the governor's office, and other factors, ranging from most conservative (0) to most liberal (100). This variable helps to concisely consider whether more generous school transportation policies are associated with more liberal state governments. Second, I include a measure of proximal policies: the percentage of neighboring states with the respective policy enacted. In other words, if a state has six neighbors and four have enacted school transportation mandates, that state would have a diffusion score of 67 percent for that policy. Because Alaska and Hawai'i do not have neighbors, I exclude them from this variable and thus construct two separate models, without and with the diffusion variable.

Table 11: Descriptive statistics for state school transportation policy adoption and characteristics

	Freq.	Pct.	Mean	SD	Min.	Median	Max.
Policy Adoption (% Yes)							
Mandate	27	54%					
Funding	41	82%					
Fees Authorized	15	30%					
Geography							
% Pop. Rural			27.6%	14.8%	5.8%	27.4%	64.9%
Fiscal Capacity							
GDP per capita ($1000s)			$57.2	$10.6	$37.0	$55.8	$83.0
Per-Pupil Expenditures ($1000s)			$12.7	$3.8	$7.3	$11.9	$23.9
Political Ideology							
Government Ideology Score			39.7	17.0	18.1	33.1	70.0
Demographics							
Med. HH Income ($1000s)			$62.6	$10.3	$45.1	$61.0	$84.8
Proximity							
% Neighbors with Mandate			54.1%	27.4%	0%	50.0%	100%
% Neighbors with Funding			81.4%	25.7%	0%	84.5%	100%
% Neighbors with Fees Auth.			29.4%	27.1%	0%	28.6%	83.3%

Government Ideology Score: Most conservative = 0; Most liberal = 100

5.3.4. Findings

To estimate the role of geography, fiscal capacity, political ideology, demographics, and diffusion in predicting a state's school transportation policies, I constructed a series of binary logistic regression models across the three key policy components: mandates, funding, and fee authorizations. The results of these models are shown in Table 12, with the left panel of each pair including all 50 states but omitting the percentage of neighboring states with positive respective policies; the right panel shows the model for just the contiguous 48 states with neighbors and includes the policy diffusion variable.

Table 12: Predictors of state school transportation policy adoption

	Model 1 Mandate		*Model 2* Funding		*Model 3* Fees Authorized	
	Non-Spatial	*Spatial*	*Non-Spatial*	*Spatial*	*Non-Spatial*	*Spatial*
	Coeff. (SE)	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**
Geography						
% Pop. Rural	0.003 (0.023)	0.001 (0.027)	0.001 (0.025)	0.022 (0.028)	−0.013 (0.029)	−0.031 (0.038)
Fiscal Capacity						
GDP per capita ($1000s)	−0.011 (0.036)	−0.014 (0.043)	—	—	—	—
Per-Pupil Expenditures ($1000s)	—	—	−1.426 (0.093)	0.040 (0.132)	—	—
Political Ideology						
Government Ideology Score	0.034 (0.021)	0.025 (0.022)	—	—	−0.013 (0.025)	−0.026 (0.028)
Demographics						
Med. HH Income ($1000s)	—	—	—	—	0.102 * (0.049)	0.139 * (0.058)
Proximity						
% Neighbors with "Yes" Policy	—	0.014 (0.014)	—	0.048 * (0.022)	—	0.037 * (0.016)
Constant	−0.622 (2.246)	−0.768 (2.496)	3.420 * (1.582)	−3.321 (3.360)	−6.561 * (3.130)	−9.289 * (3.889)
Model Statistics						
n States	50	48	50	48	50	48
Log Likelihood	−32.922	−31.291	−22.360	−18.222	-25.834	−21.257
Prob > χ^2	0.369	0.459	0.298	0.019 *	0.025 *	0.004 **
McFadden's R^2	0.046	0.055	0.051	0.213	0.153	0.266

* P < 0.05 ** P < 0.01 *** P < 0.001

Model form: Logistic regression

Non-Spatial Models = no measure of neighboring state policies, includes Alaska and Hawai'i
Spatial Models = includes measure of neighboring state policies, excludes Alaska and Hawai'i because they have no physical neighbors

Government Ideology Score: Most conservative = 0; Most liberal = 100

The results of Model 1 show that state transportation mandates were not associated with geography, fiscal capacity, political ideology, or diffusion from neighboring state policies—in other words, none of the predictors were significant. Through robustness checks, I tested several other potential explanatory variables mentioned earlier, including population density, a binary measure of the top quintile of rural states (to test for non-linearity), climate (measured by state high temperature in August and low temperature in January), the number of K-12 students in the state, state tax revenue, the percent of students of color, the number of school districts in the state, and the percent of adults who commute by public transit (as a proxy for transportation alternatives across states). None of these characteristics were significant, either. This lack of statistically significant associations—especially given the results of the models for funding and fees to which I turn next—suggests that state transportation mandates cannot be explained by contemporary state circumstances, or at least not by those I have included here. It also dispels the notion that the rurality of a state's population might lead officials there to require districts to provide more generous transportation services.

The model for state funding policies—Model 2 in Table 12—yielded different results. The probability of a given state having a school transportation funding formula was significantly associated with the policies of its neighboring states, controlling for the percent of the state's population living in rural areas and the amount of money the state spends on education per student (neither of which were significant on their own). Notably, adding the neighboring state's policies to the model resulted in the model gaining overall statistical significance. The spatial model achieved a McFadden pseudo R^2 of 0.21, a substantially better fit than the model without the neighboring policy variable (0.05). With or without this measure, neither geography nor fiscal capacity—nor any of the other measures I included in robustness checks—were significant themselves or resulted in the model gaining significance.

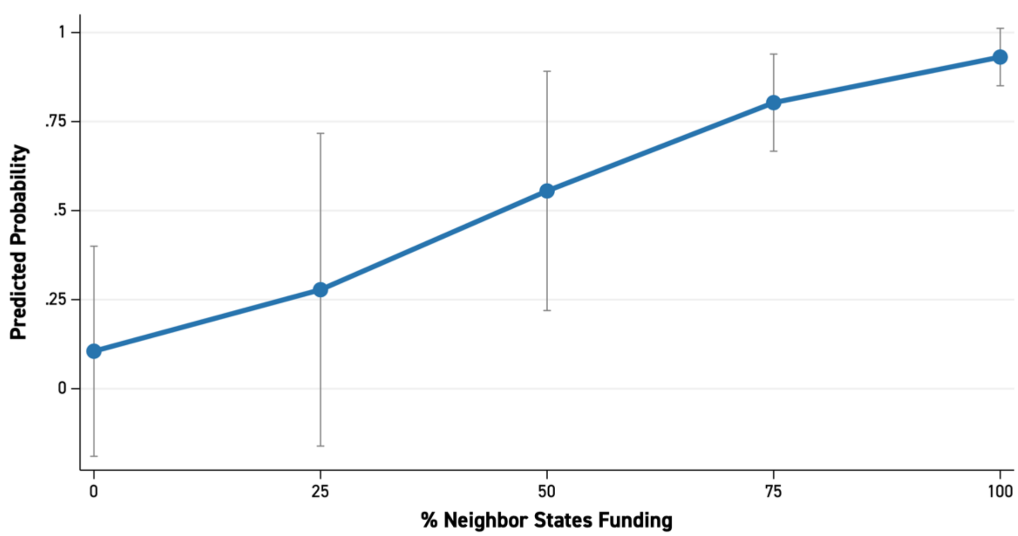
Results were strongest for Model 3, which predicted whether states authorized districts to charge transportation user fees. The probability that a state authorized fees was associated with both demographics and proximal policies, controlling for the percent of the population living in rural areas and state government ideology. Specifically, the poorest states were least likely to charge fees. And like funding, a higher percentage of neighboring states authorizing fees was associated with higher odds of fee authorizations in a given state. While adding the proximal state policy variable to this model did yield a higher McFadden pseudo R^2 (0.15 without the measure to 0.27 with it), both the non-spatial and spatial versions of Model 3 were overall significant. Further, both were better fits than the respective models for mandates and funding.

5.3.5. Discussion

In all, state school transportation policies vary substantially and cannot be explained by a single factor. Notably, despite school transportation being almost entirely predicated on enabling children to travel long distances from remote areas to a central unified school, geography—specifically the percent of students living in rural areas or population density—does not significantly explain whether states mandate the provision of school transportation, fund it, or authorize districts to charge fees for use of it.

The models suggest that the policies of neighboring states may be associated with matters of money—state funding and state authorization for districts to charge transportation user fees. Figure 15 shows the changes in predicted probabilities for varying percentages of neighboring states also funding their school transportation systems. For a state with four neighbors, an increase from one neighboring state to three neighboring states funding school transportation is associated with a 52 percentage-point change in the predicted probability of that state funding school transportation. To go from zero to four states, the predicted probability of funding changes dramatically from 0.11 to 0.93.

Figure 15: Average predicted probabilities of state school transportation funding adoption by percent of state neighbors with adopted funding policies



Controlling for this adjacency, funding does not appear to be a function of state resources or demand from higher proportions of children living in rural areas. This fits with several narratives in the literature. Scholars have repeatedly shown that education policy—particularly charter school enabling legislation—is associated with the policies of neighboring states (Mintrom & Vergari, 1998; Renzulli & Roscigno, 2005; Wong & Shen, 2002). Additionally, need for a policy was not associated with Medicaid expansion among states (Barrilleaux & Rainey, 2014), with need defined as the percentage of residents who were uninsured.

State authorizations of transportation user fees follow a similar pattern for neighboring state policies, but additionally, authorization is positively associated with state median household income. Figure 16 shows the trend of increasing predicted probability for fee authorization as the percent of neighboring states doing so also rises; Figure 17 displays changes in probability based on income quartiles. In short, states are more likely to charge fees if they have higher proportions of wealthier families, perhaps opting to extract payment for services that many families can afford. This is also in line with how state charter school programs designed for disadvantaged students proliferated more in wealthier states (Wong & Shen, 2002). The 12th-wealthiest state in the contiguous 48 states (25th percentile) has almost a 50–50 probability of authorizing user fees, while the 12th-poorest state in the Lower 48 has a predicted probability of just 0.13.

Figure 16: Average predicted probabilities of states allowing school districts to charge fees for transportation by percent of state neighbors with fees authorized

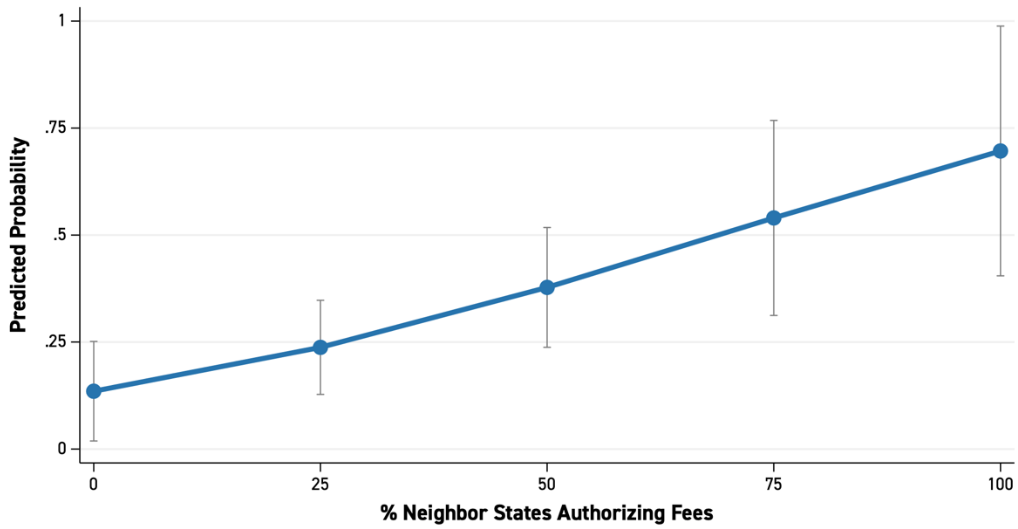
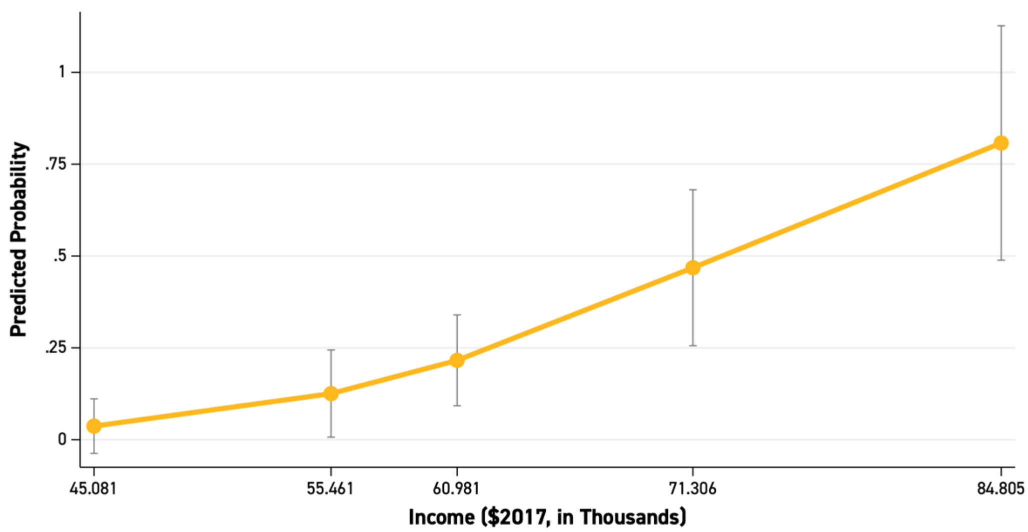


Figure 17: Average predicted probabilities of states allowing school districts to charge fees for transportation by state median household income (values at quartiles)



Several studies in education policy and other fields have considered the possibility that regionalism, rather than proximity, was associated with state-to-state policy variation (Kousser, 2002; Renzulli & Roscigno, 2005; Wong & Shen, 2002). The concern is that an apparent association between neighboring state policies might actually be associated with regional trends, masquerading as proximity effects. As a robustness check, I also estimated alternative models that include Census region indicators (Northeast, Midwest, South, and West). Census region is jointly associated with transportation mandates ($\chi^2 = 7.83$, $p = 0.0497$), but not with funding ($\chi^2 = 3.17$, $p = 0.366$) or user fee policies ($\chi^2 = 5.92$, $p = 0.116$). The Northeast and Midwest are significantly more likely to have transportation mandates than the South and West. These findings suggest that broader regional preferences may influence the adoption of transportation mandates—although the joint test is barely significant; however, funding and fee policies remain better explained by other characteristics.[34]

When controlling for the region in all three models, the neighboring state policy variables all lose significance. Perhaps the neighbor state variables were acting as policy variables for regional institutional traditions. However, the neighbor explanation remains a better explanation for funding and fees, as the region variables are jointly significant in neither the funding nor the fees model with or without the proximity variable, but the proximity variable is significant in both without the region variable. A possible explanation for this is that while regions may share institutional traditions, regions are not governments—states are. And states ultimately decide on policy.

In all, these findings—along with the corresponding robustness checks—suggest that state school transportation policies are shaped in part by the policies of surrounding states and, in the case of authorizing user fees, socioeconomic ability to pay. While there may be other factors not analyzed here that help to explain state school transportation policy adoption, most of these—such as the role of institutional legacies—fall outside the scope of this dissertation and should be explored in future research.

[34] There is one additional caveat to this robustness check. While I use the limited four-category U.S. Census regions due to sample size limitations, these regions are comprised of smaller divisions. One of these is New England. As Figure 12 demonstrates clearly, New England (except Vermont) forms a five-state block of the nine states without funding formulas. I tested adding a New England binary indicator as a control for state funding probability. Without the proximity variable included, the New England binary is significantly positively associated with state funding. However, this relationship diminishes when I re-add the generalized proximity variable.

5.4. Linking Policy Design to Student Travel Behavior

For the travel mode choice analysis in the next chapter, I synthesized the state school transportation policy data for mandates, funding, and fee authorizations across a series of common identifiers: student school level (elementary, middle, or high) and distance from home to school. This allowed me to match each school trip in the National Household Travel Survey (NHTS) to two categorical variables I derived that capture the role of state policy in influencing the school trip:

1. **Eligibility:** Whether the school trip is (A) required by the state, (B) not required by the state but for which the state does offer state transportation funding to districts, or (C) not required by the state and not eligible for any state funding.[35]
2. **User fees:** Whether the state allows a student's school district to charge a user fee to the family for the provided transportation. Importantly, this does not mean that the district ultimately charged a fee to the student's family, but it does indicate whether or not the student lives in a state that provides districts with that option.

Because the school transportation policies varied so widely across the states, each student within each state experienced these policies—and the travel options they lead to—differently. To examine the independent effect of state transportation policies on school travel behavior, I applied the consolidated eligibility thresholds in Table 9 and funding eligibility thresholds in Table 10 to each student's calculated distance between home and school in the 2017 NHTS data, based on the students' approximate age. Fees generally did not vary by age, so in nearly all cases I assigned that variable to each student based on their state of residence. Finally, I chose not to construct a reimbursement variable, because those policies varied so greatly and often required additional action on the part of the parent/caregiver and school

[35] Trips mandated by the state may or may not be eligible for state funding to districts. However, from a student's perspective, a state requiring their school district to offer them school bus service would supersede the state funding the service; that is, the student would receive the bus option regardless of whether their school district saw as much as a penny for it. Thus, I categorize both these funding situations together for the purposes of the coming chapter.

district; thus, I could not be reasonably sure if families received any state/district money for transporting their children via their own means.

5.5. Conclusion

As the data in this chapter reveal, there is a great deal of variation in U.S. state school transportation policies. These differences persist across generalized outcomes—does the policy exist or not—but even more so across the specific dimensions of these policies, such as the eligibility criteria for state policies to apply to student trips and the types of funding formulas that states use. Ultimately, one common thread is that the presences of state policies about school transportation funding and fees tend to somewhat mirror those of their neighbors.

Importantly, while it is not clear the extent to which state lawmakers considered these policy domains jointly or separately, students and their families experience these policies jointly, and simultaneously. A state may simultaneously require school transportation service, at least partially subsidize that service, and permit districts to charge a fee to their families. The applicability of each of these policies will vary student-by-student based on the distance they live from school and their grade level, and the interaction of these policies may affect student travel behaviors differently. While there is value in understanding school transportation policy from a governance perspective, such as I have done in this chapter with states, it is more important to understand how these policies affect students and their families. My analysis in the next chapter considers how these policies affect the transportation environment that individual students actually experience, which has long been a missing piece of scholars' understanding of school trip mode choice, particularly at national and state scales.

Taken together, these results suggest that school transportation policy in the United States is not a coherent national system or even a repetition of a few consistent paradigms across the states, but rather that it is a fragmented collection of state-specific approaches to solving a key problem in educational access: how to ensure students can travel to school. While broad regional and proximal policy patterns are detectable, there is substantial variation in how these policies are constructed, which in turn creates immense variation in student eligibility both within and across states. The effects of this array of policy approaches on student travel behaviors—and, in turn, on student outcomes—are potentially substantial, but have been very lightly studied to date. Before getting to the question of outcomes, I aim to examine the relationships between these policies and school travel behaviors. I turn to this in the next chapter.

6. U.S. School Travel Mode Choice

Travel to and from school—and the means by which students travel—is an important component of children's access to educational opportunities and comprises a sizable portion of peak period use of the transportation system. How children and their families choose how they travel to school in the United States is associated with a variety of factors, including the characteristics of the children, their parents/caregivers and families, their transportation resources and barriers, their schools, and their built environments. Perhaps the most salient aspect of school travel is the *mode* (family car, school bus, walk, bike, public transit, etc.) by which students travel. Research on the determinants of students' selections of school trip travel mode finds varying associations school travel mode and each of these many characteristics, resources, environments, and barriers (Ewing et al., 2004; Kontou et al., 2020; McDonald et al., 2011, 2011; Schlossberg et al., 2005; Speroni, 2023). However, what scholars have been as of yet unable to determine is how *policy* figures into these travel behaviors. Prior scholarship has not directly considered the relationship between students' choice of travel mode and the extent to which the state's (in this case) determination of which students must receive transportation services from their school districts and which of these trips warrant funding from the state to help defray the cost of those providing and consuming school travel services.

This chapter explores this association. Specifically, I examine the extent to which state school transportation policies were associated with trip mode choice for U.S. schoolchildren and their families. To answer this question, I estimate a multinomial logistic regression model that uses the three policy variables of interest from Chapter 5—state mandates for school bus service, state funding for school bus service, and state authorization for districts to charge transportation user fees—and a wide variety of other characteristics to predict travel mode across the six main means of transportation to/from school: automobile (in-household members only), carpool (automobile trip including at least one traveler from outside the household), school bus, walking, biking, and public transit.

6.1. Descriptive Results

As I showed in Chapter 4, school travel mode shares have been remarkably consistent over the past 25 years—especially coming off a half-century of substantial change before that. Table 13 shows the mode splits[36] for 2017 in the U.S. across morning trips *to* school, afternoon trips *from* school, and then pooled together. In 2017, the private automobile was the workhorse of school travel, with half of all trips occurring either as a within-household car trip or a carpool. The school bus carried over a third of all trips, while just over ten percent of students walked. Students who biked, rode public transit, or traveled by other modes made up the remaining three percent.[37]

The morning-to-school and afternoon-from-school commute data are pooled to form the outcome variable of the model, so that the model can control for both morning and afternoon trips as explanatory factors. As Table 13 shows, the distribution of trips between the morning and afternoon periods was roughly proportionate. While theoretically they should be exactly equal—a student who travels to school must also leave school at some point, save for boarding school students—there are some nuances to the travel day diaries that eliminate the afternoon trip. For example, suppose a student who travels to school in the morning reports the trip as a school trip. Then, in the afternoon, this same student may remain at school to participate in an extracurricular activity like band practice; there is no school departure trip, as band practice is at the school, but the student reports the trip home as a different type of origin activity. Still, the morning-afternoon difference in the sample was only about one percent.

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[36] As I describe in Chapter 4, "mode split" is the term that transportation analysts use to describe the proportional distribution of a given set of travelers across various travel modes (driver, vehicle passenger, public transit, bike, walk, etc.) for a given type of trip.

[37] Students using the "other" travel mode include golf carts (9 trips), motorcycles (6), RVs (5), charter buses that are not school or transit buses (75), taxi/ridehail (12), rental car (1), and "something else" (72). The "something else" descriptions are not available in the public use NHTS data file. Because these available modes are so different, I exclude this option from the model.

Table 13: School trip travel mode by morning (to school) and afternoon (from school)

Travel Mode	Unweighted Freq.	Unweighted Pct.	Weighted Pct.
AM Only			
Automobile (In-Household)	7,180	47.9%	40.8%
Automobile (Carpool)	2,059	13.7%	12.2%
School Bus	4,351	29.0%	34.9%
Walk	1,009	6.7%	9.0%
Bike	194	1.3%	0.8%
Public Transit	128	0.9%	1.8%
Other*	79	0.5%	0.4%
Total AM	15,000		
PM Only			
Automobile (In-Household)	5,633	39.6%	34.0%
Automobile (Carpool)	1,953	13.7%	12.7%
School Bus	4,832	33.9%	37.5%
Walk	1,410	9.9%	12.5%
Bike	182	1.3%	0.8%
Public Transit	133	0.9%	1.8%
Other*	101	0.7%	0.6%
Total PM	14,244		
Both AM and PM**			
Automobile (In-Household)	12,813	43.8%	37.5%
Automobile (Carpool)	4,012	13.7%	12.5%
School Bus	9,183	31.4%	36.2%
Walk	2,419	8.3%	10.7%
Bike	376	1.3%	0.8%
Public Transit	261	0.9%	1.8%
Other*	180	0.6%	0.5%
Total	29,244		

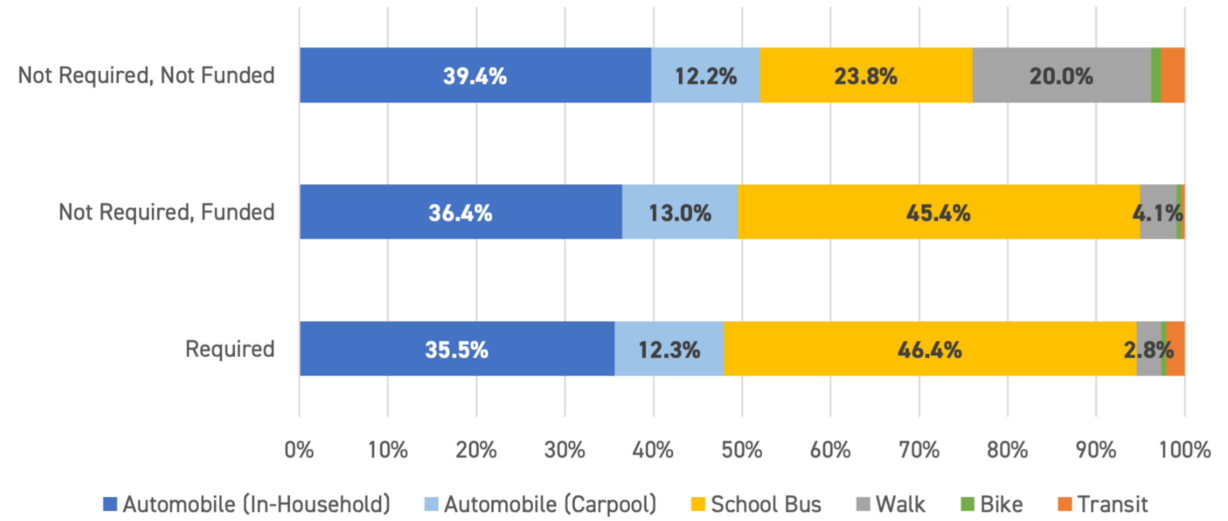
* "Other" modes excluded from model
** Model outcome variable

Data Source: NHTS 2017

Figure 18 shows how the school trip mode split varied across combinations of the first two state school transportation policy regimes—states requiring districts to offer school bus service and states funding school bus service—as those regulations apply to each student trip based on the student's school grade level (elementary, middle, and high) and home-to-school distance.[38] I combine these because they both serve the same purpose: to compel districts to offer service—and because a student experiences the policies jointly in whether or not their district offered a school bus. Among trips that meet their respective states' criteria for mandatory school bus service provision, just under half (46.4%) are via yellow school bus. Trips that meet the eligibility criteria for state school transportation funding but not for required service—either because the state does not require it or because the student lives too close to school to be eligible—the school bus mode share is nearly the same (45.4%). For trips that are neither required nor funded—either because their state does not have such a policy or because they live too close to school to be eligible—less than a quarter (23.8%) of trips are taken by school bus. These results are, of course, logical: many trips were neither state-required nor state-supported *because* they were short trips that students could take by walking, even in states where longer trips would be state-supported. The point of the policies is to ensure access to education for students who live too far away from school to walk. Notably, the share of automobile use for these non-required, non-funded trips shrank only minimally compared to the state-supported trips. The model results reveal the extent to which this pattern does or does not hold true controlling for distance.

[38] Take for example trips taken by a hypothetical middle-school student who lived 1.6 miles from school in New Mexico. New Mexico requires and funds school transportation for home-to-school distances of at least one mile for elementary students, 1.5 miles for middle school, and two miles for high school. This hypothetical middle school student's trips would be considered "Required," because state law requires districts to provide transportation to all students in sixth through eighth grade who live beyond 1.5 miles from school. However, I would classify that student's neighbor living 1.4 miles from school as "Not Required, Not Funded," because they live inside that threshold and thus are not eligible for bus service *under state law*. I apply this separately based on age because in some states, like New Mexico, the home-to-school distance eligibility criteria vary by age. If that first hypothetical student were a high school student, their trips would be "Not Required, Not Funded," because they would need to live two or more miles from school for their trips to be required by state law. Note that districts can choose to offer transportation to students who live inside state requirement and funding eligibility thresholds but typically must do so with locally-controlled funds.

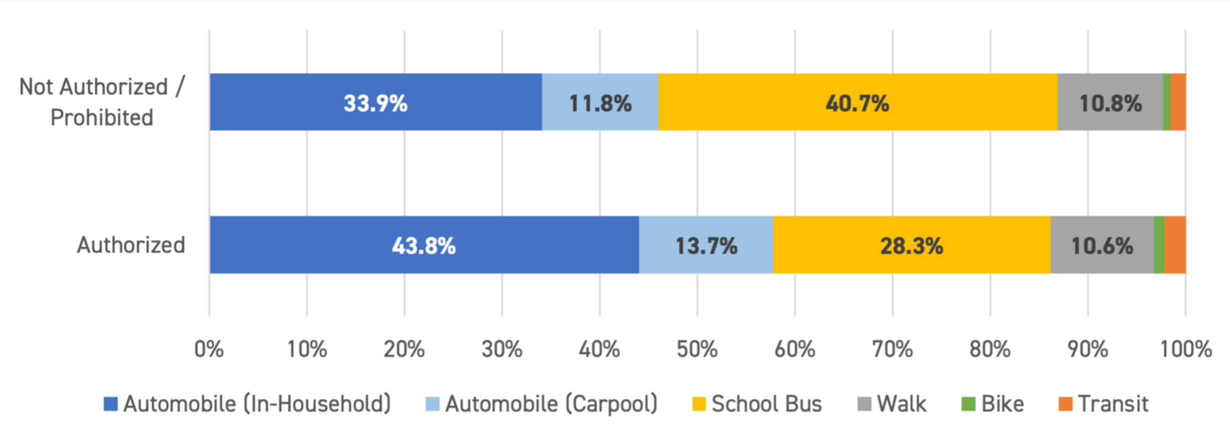
Figure 18: School trip mode choice by state policy eligibility



Value labels suppressed for values < 3%.
Data Source: NHTS 2017 and U.S. State School Transportation Policy Inventory

Conversely, when states affirm policies that authorize their districts to charge school transportation user fees, the school bus mode share descriptively shrinks. Figure 19 shows the school trip mode split by whether the trip occurred in a state that did not authorize or expressly prohibited user fees (on the top) or a state that authorized user fees (on the bottom). In states where school bus fees are illegal, 41 percent of trips are school bus trips; forty-six percent of trips are in automobiles. But in states where school bus fees are permitted, 57 percent of trips happen in cars while only 28 percent of trips are on school buses. Eleven percent of school trips are walking trips, regardless of whether school bus user fees are legal.

Figure 19: School trip mode choice by state authorization of school transportation user fees



Value labels suppressed for values < 3%.
Data Source: NHTS 2017 and U.S. State School Transportation Policy Inventory

Table 14 displays the independent variables in the model. Each of the variables is rooted in prior scholarship; the new state policy variables are derived from Chapter 5. These predictors include characteristics of the student traveler, the student's caregivers and household, the trip, the household's transportation resources, and the built environment near the student's home. (See Table 1 in Chapter 2 and Figure 2 in Chapter 3 for more detail.) Table 14 includes the unweighted frequencies and distributions, as well as the weighted distributions, of each of the variables in the models. The weighted distributions are based on the survey weights that the FHWA provides with the NHTS.

Table 14: Descriptive statistics for U.S. mode choice analytic sample

Variable	Unweighted Freq.	Unweighted Pct.	Weighted Pct.
State Policies			
State trip eligibility			
Not required, not funded	13,110	45.1%	43.7%
Not required, funded	8,128	28.0%	31.7%
Required, funded	7,826	26.9%	24.6%
State permits school bus user fee			
No	14,959	51.5%	64.0%
Yes	14,105	48.5%	36.0%

Variable	Unweighted Freq.	Unweighted Pct.	Weighted Pct.
Student			
School level (Age)			
Elementary	15,316	52.7%	55.4%
Middle	7,183	24.7%	23.6%
High	6,565	22.6%	21.0%
Student gender			
Male	14,919	51.3%	51.3%
Female	14,145	48.7%	48.7%
Student disability			
No	28,663	98.6%	98.5%
Yes	401	1.4%	1.5%
Siblings			
0	7,209	24.8%	21.7%
1	12,638	43.5%	44.3%
2+	9,217	31.7%	34.0%
Driver (any age)			
No	26,161	90.0%	91.8%
Yes	2,903	10.0%	8.2%
Race/ethnicity			
Asian	1,735	6.0%	5.5%
Black	2,727	9.4%	15.6%
Latino/a	4,415	15.2%	20.5%
White	17,946	61.8%	51.0%
Other	2,241	7.7%	7.5%
Caregiver / Household			
Household structure			
Single-parent	4,719	16.2%	18.6%
2+ Adults	24,345	83.8%	81.4%
Household income			
< $25,000	3,723	12.8%	19.8%
$25,000 – $49,999	4,472	15.4%	17.5%
$50,000 – $74,999	4,537	15.6%	14.8%
$75,000 – $99,999	3,947	13.6%	13.1%
$100,000 – $149,999	6,597	22.7%	20.0%
$150,000 – $199,999	2,704	9.3%	6.8%
≥ $200,000	3,084	10.6%	8.1%
Homeowner			
No	7,066	24.3%	35.2%
Yes	21,998	75.7%	64.8%
Foreign-born parent (1+)			
No	23,122	79.6%	75.9%
Yes	5,943	20.4%	24.1%
Parent with med. cond. (1+)			
No	27,467	94.5%	94.9%
Yes	1,597	5.5%	5.1%
Parent with college degree (1+)			
No	10,532	36.2%	43.6%
Yes	18,532	63.8%	56.5%
Parent with flex. work schedule			
No	5,149	17.7%	18.4%
Yes	23,915	82.3%	81.6%

Variable	Unweighted Freq.	Unweighted Pct.	Weighted Pct.
Trip / Transportation			
Distance home-to-school (mi.)			
<0.5 mi.	1,879	6.5%	7.0%
0.5–0.99 mi.	3,504	12.1%	13.0%
1.0–1.5 mi.	3,034	10.4%	10.2%
1.5–1.99 mi.	2,848	9.8%	11.0%
2.0–2.99 mi.	4,344	15.0%	16.2%
3.0–4.99 mi.	5,269	18.1%	17.5%
≥5 mi.	8,186	28.2%	25.1%
Trip time			
AM	14,921	51.3%	51.3%
PM	14,143	48.7%	48.8%
Trip day of week			
Monday	5,170	17.8%	18.5%
Tuesday	6,089	21.0%	20.9%
Wednesday	5,967	20.5%	21.1%
Thursday	6,193	21.3%	20.4%
Friday	5,645	19.4%	19.2%
Trip season			
Fall	12,124	41.7%	38.2%
Winter	8,866	30.5%	26.5%
Spring	8,074	27.8%	35.3%
Household vehicle status			
Zero vehicles	248	0.9%	1.9%
Vehicle deficit	3,125	10.8%	14.9%
Vehicle+ per driver	25,691	88.4%	83.3%
Built Environment			
Household in major metro			
No	15,193	52.3%	43.6%
Yes	13,871	47.7%	56.5%
Neighborhood type (Urbanicity)			
Urban	2,887	9.9%	16.7%
Second city	7,570	26.1%	25.0%
Suburban	5,666	19.5%	20.7%
Small town	6,815	23.5%	20.6%
Rural	6,126	21.1%	17.1%
Population density (per./sq.mi.)*			
0–99	3,230	11.1%	9.5%
100–499	4,630	15.9%	12.9%
500–999	2,581	8.9%	8.7%
1,000–1,999	4,088	14.1%	11.7%
2,000–3,999	5,822	20.0%	19.7%
4,000–9,999	6,988	24.0%	27.2%
10,000–24,999	1,403	4.8%	7.3%
≥25,000	322	1.1%	3.1%
N	29,064		

* Population density omitted from model because it is a partial determinant of urbanicity.

Data Source: NHTS 2017 and U.S. State School Transportation Policy Inventory

6.2. Limitations

While the model results I present in the next section offer many insights into the effect of state school transportation policies on student travel, controlling for standard predictors of mode choice, it is not without limitations. Chief among these is that the public nature of these data preclude access to data on the location of students and their schools. This means that I cannot be certain that a student attended the school to which they were assigned by their public school district, nor can I be sure they attended public school at all. (I can and do exclude homeschool students because their travel distances are zero, and because the NHTS includes a question about homeschooling.) The principal issue here is that many states have varying policies for public choice school students (charters, magnets, and intra- and inter-district choice programs) as well as private schools (McShane & Shaw, 2020). This admittedly introduces noise into the models. However, what this model still *can* show is that—controlling for a wide variety of other characteristics known to influence travel—a state policy that either requires and/or funds school bus service could have a statistically significant association with school bus use downstream, regardless of students' enrollment in school choice programs. If anything, the model is a conservative estimate of this potential effect because the policies would affect only a portion of the students involved. Results from the 2019 Parent and Family Involvement Survey of the National Household Education Surveys Program reveal that roughly 79 percent of U.S. K–12 students attended the neighborhood zone public schools to which their districts assigned them (National Center for Education Statistics, 2024a) and thus were directly affected by the state school transportation policies that I analyze in this chapter.

The model I present in this chapter also lacks school location data. While I am privy to general data about where the student lives, I do not have access to location data on the trip destination: the school. A student may live in an urban area, but they might travel to a school in a suburban area—I would not predict the travel mode choice of that student to be the same as a student who lives *and* attends school in an urban area. Fortunately, I am able to incorporate data on school location into my analyses of California district school transportation policies in Chapter 8.

Third, the NHTS includes two measures of the built environment around a student's home, one of which is the five-category neighborhood typology and the second is a population density variable divided into arbitrary categories to protect respondent confidentiality. Because the NHTS built-environment-type variable uses population density as a component, I chose not to include both variables. Further, because identifying a place as a "suburb" is a much more commonly understood description than the number of residents per square mile, I chose to retain the neighborhood type variable. For all other variables, I tested for multicollinearity using the Variance Inflation Factor (VIF) in a linear regression predicting school trip distance, which can only be done without survey weights. The maximum VIF was 2.19, suggesting no issues with multicollinearity.

Fourth, I largely do not directly address the important topic of disability in this analysis. School transportation is a critically important component of a disabled student receiving the free appropriate public education that the federal government guaranteed to them in the Individuals with Disabilities Act of 1990 and its subsequent reauthorizations. Students with an Individualized Education Program (IEP) can have transportation written into their plans as an accommodation, thus guaranteeing them appropriate transportation regardless of the state's policies (Caceres et al., 2019; Education for All Handicapped Children Act, 1975). Despite this policy, and despite my model revealing a jointly-tested association between student disability and mode choice for all modes, I did not find a significant association between student disability and school bus use. This finding may be due to a difference in the definition of disability in the NHTS (a physical mobility impediment) and how educators classify disability (which could be a variety of rationales, including social-emotional disabilities). Though I did not find the increased odds of school bus use that I had predicted, student disability was associated with lower odds of bicycle and public transit use. Of note, however, is that while scholars often focus on student disability (Gottfried et al., 2021; Graham et al., 2014; Ross et al., 2020), in my model *parent* disability was significantly associated with travel mode choice. Students having at least one disabled parent instead of having no disabled parents was associated with a 60-percent increase in the odds of school bus use compared with riding in the family car. Such students were also more likely to bike.

Fifth, I was interested in the potential difference in overall results for models applied to only elementary, only middle, and only high school students. However, the model as constructed is constrained by the small size of the bike and transit outcomes. While the numbers of trips taken on those outcome modes are large enough to be estimated for all grade levels combined, those outcomes are too small to be divided into three and still include all of the predictors I have included in the model. Therefore, I only estimate one model, but one that does control for the three school grade levels.

And finally, the results of this model are associational and do not demonstrate the causal effect of state school transportation policy (or any other predictor) on student travel mode selection.

6.3. Model Results

Table 15 shows the results of the multinomial logistic regression model that predicts student school trip travel mode. The reference travel mode is the in-household automobile trip, with all five other possible travel modes compared with it. In this section, I examine the associations between each group of predictor variables and the five mode alternatives to single-family driving. First, I describe the overall significance of the predictor variables across the model using Wald tests (the first column to the right of the variables in the table); then, I highlight a few key associations between predictor variables and travel mode outcomes.[39] Finally, I pay close attention to the policy variables and test the null hypothesis that state school transportation policy is not associated with student travel mode choice. Table 15 presents the results using log odds coefficients; these are effective in explaining unit changes in a consistent distance

[39] I use Wald F tests in part to explain overall significance of categorical variables, but also because traditional test statistics for multinomial logistic regression models, such as McFadden's Pseudo R^2, AIC, and BIC are not available when survey weights or clustering are applied, both of which I rely on in this model (see Chapter 3). I conduct likelihood-ratio tests later in the chapter using unweighted versions of the model as a robustness check.

from zero. In the narrative, I contextualize these by explaining the change in the odds, which is the exponentiation of the log odds, otherwise known as the relative risk ratio.

As a robustness check, I estimated an additional version of the model with standard errors clustered by state (rather than by student). Because most individuals appear twice in the model with identical predictors other than outcome travel mode and trip time, I retain the version of the model with standard errors clustered by the student.

Table 15: Predictors of U.S. school trip mode choice

Variable	Wald P>F	Carpool		School Bus		Walk		Bike		Public Transit	
		Coeff	P>z	Coeff	P>z	Coeff	P>z	Coeff	P>z	Coeff	P>z
State Policies											
State Trip Eligibility	0.000 ***										
Not required, not funded		Ref		Ref		Ref		Ref		Ref	
Not required, funded		-0.117	0.336	0.349 **	0.002	-0.163	0.461	0.566	0.112	-1.865 ***	0.000
Required		-0.182	0.223	0.350 **	0.006	-0.030	0.899	0.647	0.245	-0.508	0.104
State Permits School Bus User Fee	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.191	0.051	-0.538 ***	0.000	-0.506 ***	0.000	0.090	0.781	-0.918 ***	0.000
Student											
School Level (Age)	0.000 ***										
Elementary		Ref		Ref		Ref		Ref		Ref	
Middle		0.129	0.251	0.354 ***	0.000	1.178 ***	0.000	1.899 ***	0.000	1.350 ***	0.000
High		0.112	0.466	-0.033	0.793	1.706 ***	0.000	0.917 *	0.034	2.103 ***	0.000
Student Gender	0.004 **										
Male		Ref		Ref		Ref		Ref		Ref	
Female		0.135	0.155	-0.183 *	0.024	-0.128	0.298	-0.831 *	0.015	-0.314	0.165
Student Disability	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.588	0.156	0.418	0.139	-0.342	0.677	-21.086 ***	0.000	-1.921 *	0.028
Siblings	0.363										
0		Ref		Ref		Ref		Ref		Ref	
1		0.079	0.526	0.087	0.435	0.100	0.539	0.584	0.201	-0.386	0.172
2+		0.081	0.533	0.199	0.085	0.285	0.079	0.518	0.237	-0.538	0.141
Driver (any age)	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.405	0.057	-1.523 ***	0.000	-2.123 ***	0.000	-2.092 *	0.020	-2.640 ***	0.000
Race/Ethnicity	0.001 ***										
Asian		0.336	0.124	0.042	0.822	-0.355	0.273	-0.147	0.731	-1.085 *	0.027
Black		-0.087	0.637	0.235	0.145	0.030	0.896	-2.567 **	0.001	0.563	0.063
Latino/a		0.167	0.197	-0.160	0.191	-0.336	0.051	-1.097 *	0.045	-0.196	0.567
White		Ref		Ref		Ref		Ref		Ref	
Other		0.044	0.819	0.035	0.833	-0.075	0.743	-0.677	0.127	-0.810	0.096

Variable	Wald P>F	Carpool		School Bus		Walk		Bike		Public Transit	
		Coeff	P>z	Coeff	P>z	Coeff	P>z	Coeff	P>z	Coeff	P>z
Caregiver / Household											
Household Structure	0.010 *										
Single-parent		0.457 **	0.002	0.031	0.809	0.379 *	0.036	0.842	0.078	0.328	0.272
2+ Adults		Ref		Ref		Ref		Ref		Ref	
Household Income	0.002 **										
< $25,000		-0.017	0.940	0.454 *	0.014	0.267	0.378	-0.352	0.612	0.222	0.608
$25,000 – $49,999		-0.029	0.873	0.032	0.844	-0.214	0.470	-1.196 **	0.008	-0.542	0.217
$50,000 – $74,999		-0.089	0.609	0.087	0.582	-0.009	0.974	0.422	0.429	-0.785	0.096
$75,000 – $99,999		Ref		Ref		Ref		Ref		Ref	
$100,000 – $149,999		0.129	0.426	0.118	0.396	0.157	0.569	0.001	0.999	-0.390	0.341
$150,000 – $199,999		0.125	0.514	-0.067	0.726	0.588 *	0.042	0.789	0.116	-0.587	0.426
≥ $200,000		0.170	0.388	-0.190	0.244	0.298	0.290	0.307	0.541	0.278	0.581
Homeowner	0.005 **										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.213	0.051	-0.240 *	0.023	-0.339 *	0.018	-1.018 *	0.011	-0.538 *	0.022
Foreign-Born Parent (1+)	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.395 **	0.002	0.328 **	0.003	0.272	0.068	0.033	0.924	0.140	0.646
Parent with Med. Cond. (1+)	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.297	0.122	0.470 **	0.004	-0.435	0.115	1.166 *	0.037	0.541	0.171
Parent with College Degree (1+)	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.236	0.062	-0.499 ***	0.000	-0.521 **	0.001	0.465	0.268	-0.434	0.135
Parent with Flex. Wk. Sched.	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.666 ***	0.000	-0.257 *	0.027	-0.126	0.497	-0.283	0.510	-0.726 *	0.027
Trip / Transportation											
Distance Home-to-Sch (miles)	0.000 ***										
<0.5 mi.		Ref		Ref		Ref		Ref		Ref	
0.5-0.99 mi.		0.006	0.978	-0.019	0.948	-1.542 ***	0.000	0.681	0.084	1.389	0.223
1.0-1.5 mi.		0.464 *	0.037	0.354	0.227	-2.279 ***	0.000	0.230	0.577	2.202	0.057
1.5-1.99 mi.		0.368	0.112	0.791 **	0.006	-3.287 ***	0.000	-0.643	0.204	1.945	0.089
2-2.99 mi.		0.606 **	0.009	0.800 **	0.005	-3.703 ***	0.000	-1.626 **	0.004	2.577 *	0.020
3-4.99 mi.		0.533 *	0.023	0.809 **	0.005	-3.937 ***	0.000	-3.223 ***	0.000	3.007 **	0.008
≥5 mi.		0.721 **	0.001	0.746 **	0.008	-4.286 ***	0.000	-1.197	0.084	3.466 **	0.002

Variable	Wald P>F	Carpool Coeff	Carpool P>z	School Bus Coeff	School Bus P>z	Walk Coeff	Walk P>z	Bike Coeff	Bike P>z	Public Transit Coeff	Public Transit P>z
Trip time	0.000 ***										
AM		Ref		Ref		Ref		Ref		Ref	
PM		0.226 ***	0.000	0.271 ***	0.000	0.668 ***	0.000	0.298 **	0.005	0.195	0.138
Trip Day of Week	0.049 *										
Monday		-0.053	0.739	-0.031	0.817	0.135	0.501	-0.722	0.102	0.456	0.354
Tuesday		-0.049	0.731	0.257 *	0.043	0.058	0.750	-0.306	0.440	1.093 **	0.005
Wednesday		Ref		Ref		Ref		Ref		Ref	
Thursday		-0.033	0.821	0.216	0.095	-0.130	0.473	0.025	0.960	0.774 *	0.049
Friday		-0.164	0.275	0.314 *	0.015	-0.020	0.908	-0.029	0.947	0.673	0.094
Trip season	0.581										
Fall		Ref		Ref		Ref		Ref		Ref	
Winter		0.024	0.825	0.029	0.760	-0.063	0.659	0.317	0.369	0.619 *	0.049
Spring		0.051	0.661	-0.031	0.754	-0.117	0.414	-0.251	0.525	0.119	0.678
Household Vehicle Status	0.000 ***										
Zero vehicles		1.897 ***	0.000	2.962 ***	0.000	3.638 ***	0.000	1.507	0.080	4.975 ***	0.000
Vehicle deficit		-0.327 *	0.032	0.496 ***	0.000	0.957 ***	0.000	0.150	0.704	1.237 ***	0.000
Vehicle+ per driver		Ref		Ref		Ref		Ref		Ref	
Built Environment											
Household in Major Metro	0.000 ***										
No		Ref		Ref		Ref		Ref		Ref	
Yes		-0.037	0.747	0.551 ***	0.000	0.227	0.138	-0.145	0.606	0.666	0.066
Neighborhood type (Urbanicity)	0.000 ***										
Urban		-0.049	0.735	-1.135 ***	0.000	0.296	0.067	0.717	0.114	2.148 ***	0.000
Suburban		Ref		Ref		Ref		Ref		Ref	
Second City		-0.224	0.144	-0.311 *	0.018	-0.004	0.982	0.097	0.840	0.117	0.802
Small Town		0.057	0.683	0.364 **	0.002	-0.413 *	0.044	-0.869	0.145	-1.837 *	0.014
Rural		-0.280	0.105	0.367 **	0.006	-0.396	0.165	-0.642	0.415	-2.222 **	0.009
Constant		-0.754 *	0.040	-0.876 *	0.014	0.624	0.160	-3.630 ***	0.003	-6.759 **	0.000

n = 29,064   * P < 0.05   ** P < 0.01   *** P < 0.001

Reference mode: Automobile (In-Household)
Model form: Multinomial logistic regression
Model is weighted using person weights provided in the NHTS.
Standard errors clustered by individual to account for AM and PM trips for each student.

6.3.1. State Policy

Turning first to the policy variables of interest, I find that across a variety of statistical tests that state school transportation policy, all else equal, was significantly associated with students' school trip travel mode choices. This was true for the combined state-supported trip eligibility variable (requirement and/or funding) and the state authorization of transportation user fees, both separately and together. Using a Wald test, both variables were significant (State support: $F = 3.74$, $P>F = <0.001$; Fees: $F = 10.62$, $P>F = <0.001$). To compare and to test their collective effects on the model, I also conducted likelihood-ratio tests by fitting three constrained models—one with neither state policy variable, one with only the state trip eligibility variable, and one with only the fee variable—and comparing each against an unconstrained model including both variables.[40] The results of all three tests were significant; the constrained models with only the state trip eligibility variable (LR $\chi^2 = 493.81$; $P>\chi^2 = <0.001$), only the fees variable (LR $\chi^2 = 126.21$; $P>\chi^2 = <0.001$), and omitting both variables (LR $\chi^2 = 878.38$; $P>\chi^2 = <0.001$) were all significantly different from the unconstrained model.

Given the results of the Wald tests, the likelihood-ratio tests that confirm a significant relationship between the two policy variables—state-supported trip eligibility and state authorization of transportation user fees—and school travel mode choice, I reject the null hypothesis that one, the other, or both policy variables have no meaningful effect on travel mode choice to/from school. In other words, state policy *does* matter in how families choose their means of transportation to and from school for their children.

[40] The likelihood-ratio test uses unweighted models to compare a constrained model that omits state-supported trip eligibility and district fee-charging permission and an unconstrained model that includes both variables. I report the results here to contextualize the Wald tests; however, the weighted model is better suited for full interpretation due to the uneven sample distribution across states.

More specifically, a trip can be (A) neither required nor funded (the reference category), (B) not required but funded by the state, or (C) required by the state.[41] Perhaps obviously, a school trip that met the state's criteria for requiring a school district to provide school bus service, instead of a trip that was neither required nor funded by the state, was associated with an increase in odds of using the school bus rather than the family car, by roughly 41 percent. But surprisingly, the effect size was nearly the same—again it rounds to a 41 percent increase in the likelihood of riding a school bus—for trips that only received state funding but were not formally required. Eligibility for state-supported school transportation did not significantly predict carpooling, walking, or biking as compared with driving. Any potential effect of state-supported school bus eligibility on walking seems to have been offset by trip distance and other predictors, as the relationships between the policy predictors and walking are statistically significant in a restricted model with no other predictors (carpooling and biking are not). There was also a significant association between a funded trip and lower odds of public transit use over driving; this is likely due to state school bus funding allowing districts to avoid relying on public transit for school transportation instead.

While eligibility for state-supported school bus transportation tended to increase the odds of school bus use over private car use, a state allowing districts to charge fees for school bus transportation had the opposite effect. A school trip in a state that allows districts to charge families for school transportation compared to a trip in a state that prohibits such charges was associated with reduced odds of school bus use (compared to driving) by 42 percent. But less predictably, a trip with fees authorized instead of fee-free was also significantly associated with decreased odds of walking and public transit use. The state authorization of user fees was not significantly associated with either carpooling or biking. In

[41] Recall from the previous chapter that I categorize required trips together, whether the state offers funding or not, because students experience the required trip the same way, with or without state funds. Additionally, the small number of states—many of which are also small in population—with unfunded mandates for school transportation limits my ability to classify them separately.

short, it appears that fees may cause the worst-case scenario for transportation planners: little or no change in all non-single-family driving modes, even as the odds of walking and public transit use decline.

As a robustness check, I re-estimated the model using standard errors clustered by state to account for the potential correlation among students exposed to the same state policy environment. This would be a more conservative approach to this analysis. The coefficients remained largely unchanged, and most variables' significance levels remained the same. Standard errors increased for the state trip eligibility variable across the five non-reference outcomes, but the variable retained its overall significance using a Wald test ($F = 2.22$, $P>F = 0.015$). The relationships between school bus use and trips that were funded but not required and trips that were required were both still significant but at the $\alpha = 0.10$ level. Standard errors for the fees variable increased across the five outcome travel modes but more modestly than they did for state trip eligibility. Fees retained their overall significance ($F = 3.01$, $P>F = 0.013$) and the relationship between school bus use and fees remained statistically significant at the $\alpha = 0.05$ level.[42]

6.3.2. Student Characteristics

Much of the prior literature has paid close attention to the student characteristics associated with travel mode choice. The model results are largely consistent with that work. Of the six predictor variables in the model, only the number of siblings was not significantly associated with a student's travel mode choice overall, using Wald tests. Across the non-automobile mode options, middle school students were more likely than elementary-aged children to travel by school bus, walk, bike, or public transit, all

[42] Ultimately, the robustness model results suggest a bit of caution in interpreting the primary model. However, some of the increase in the standard errors can be attributed to the sampling structure of the NHTS. Unlike some education surveys, such as the High School Longitudinal Survey (HSLS) and the Early Childhood Longitudinal Survey (ECLS), the NHTS is expressly not designed for within-state analysis. The NHTS is a stratified random sample across the U.S.; although the survey design includes a minimum number of households sampled by state, states are not sampling units. In contrast, the HSLS and ECLS both use a sampling strategy that begins with a sample of schools and then within those schools a sample of students. In the analytic sample that I use in this chapter, the NHTS has a large range of observations per state, from 23 trips in New Mexico to 7,277 trips in Texas, and several states contain few (if any) observations for particular modes. For example, in the analytic sample Alabama has zero walkers, not because children do not walk to school in Alabama but because the sample of trips from that state is very small. Those observations in states like Alabama and New Mexico still have variation in the state school transportation policy exposure—some children are bus-eligible while others are not. These variations are captured in the primary model. But, the small-sample states provide very little information for estimating within-state relationships and limits the precision of the model with standard errors clustered by state.

else equal. High school students, in contrast, were more likely to walk, bike, or take public transit, but they were no less likely to use the school bus over the single-family automobile compared to elementary school students, again controlling for the other characteristics. This finding may be because one of the other characteristics the model controls for was possession of a driver's license, and that had a *clear* association with school travel mode. Having a driver's license reduced the odds of taking the school bus by roughly 78 percent; both walking and biking by 88 percent; and taking public transit by 92 percent. Also consistent with previous studies on school mode choice, girls were less likely than boys to use the school bus or public transit, again compared with being driven or driving.

A student's race/ethnicity, while overall significant, only had significant associations comparing driving with bicycling and public transit use; being Black instead of white was associated with a reduced odds of bicycle use by 92 percent, and by 67 percent if the student was Latino instead of white. Meanwhile, Asian students were significantly less likely than white students to use public transit compared with the family car. Notably, race/ethnicity does not significantly predict any of the associations for the carpool, school bus, or walk modes, relative to single-family driving.

6.3.3. Caregiver/Household Characteristics

The characteristics of parents/caregivers and households also were associated with school trip mode choice. While all seven predictor variables were statistically significant overall, some offered more insight than others. Household income had surprisingly few significant associations comparing driving to other modes and offered little clarity.[43] Compared to students in middle-income families ($75,000–$99,999), the poorest students (household incomes <$25,000) were more likely to ride the school bus than

[43] Income is a predictor of two other key variables: homeownership, and vehicle access and ownership. These variables did not suffer from multicollinearity in my tests for it. However, to test the assumption that income informs homeownership and/or vehicle access, I estimated the model without these two variables. First, I tested without vehicle ownership but with homeownership retained, since I see vehicle access as a theoretically stronger link to travel mode. Without vehicle ownership, the overall results for income were that Wald P>F = <0.001. In addition to the significant results in the primary model, the highest-income group was less likely to ride the school bus, the lowest income group was more likely to walk or take public transit. There was still little predictive power among the middle-income groups. Second, without both variables the model results are nominally similar to those of the model removing vehicle access.

to travel by family car. Again, compared to middle-income students, a student from a moderately-wealthy family ($150,000–$199,999) was associated with greater odds of walking, and a student from a moderately-low-income family ($25,000–$49,999) was significantly less likely to bike than drive. But in all, income proved to be a spotty predictor: there were no consistent trends that applied across adjacent income groups (e.g., nothing consistent across the three poorest income groups for a given mode).

Perhaps an explanation for household income's lack of statistically significant relationships was the role of homeownership: Living in owned versus rented homes was associated with significantly lower odds of students taking the school bus, walking, biking, and taking public transit. In other words, students living in rented homes were more likely to rely on modes other than the car, pooled or not.

Parents and caregivers are—obviously—important figures in the school mode choice decision. Materially, they are often the chauffeurs for school trips. Statistically, their characteristics also matter in mode choice decisions. A student having at least one parent who was born outside the U.S. was significantly associated with higher odds of taking the school bus but lower odds of carpooling. Children whose parent had a disability were also significantly more likely to take the school bus (by a factor of 1.6), as well as bike (by a factor of 3.2). Conversely, having at least one college-degree-holding parent instead of parents without college degrees was significantly associated with lower odds of school bus use and walking. That is, educated parents were more likely to drive their children to and (to a slightly lesser extent, from) school. Finally, parental work schedules also matter; having a parent with a flexible work schedule instead of both parents with inflexible schedules was associated with lower odds of carpooling, school bus use, and public transit use than family-only car use. Put plainly, parents who *can* drive their children tend to do so, all else equal.

6.3.4. Trip Characteristics

Of the five variables in the model concerning the characteristics of the trip and the family's transportation resources, four were significantly associated with school travel mode choice. Trip season was the lone non-significant predictor; it seems that winter and spring trips do not differ significantly from fall trips.

Predictably, the distance a student lived from their school was a reliable predictor of mode choice. This is common sense, of course, but there was some nuance to the findings. The simplest relationship is the most logical; the odds of walking compared to riding in an automobile with only household members decreased as distance to school increased. It would seem obvious that a student who lived five or more miles from school instead of living less than a half-mile from school was associated with a 99-percent decrease in the odds of walking relative to driving, but even just the next distance band up—a half-mile to a mile instead of under a half-mile—was associated with reducing the odds of walking than driving by 79 percent. Biking functioned similarly: living at least two but less than five miles from school instead of less than a half mile was associated with significantly lower odds of students bicycling.

Conversely, the odds of students carpooling, riding on a school bus, or taking public transit each increased as distance from home to school increased. Carpooling becomes more likely than driving at a one-mile distance (except for 1.5–1.99 miles), school bus use becomes more likely at 1.5 miles, and public transit use becomes more likely at two miles. Take for example a student who lives at least two but less than three miles from school: such a distance, relative to living within a half mile of school, was associated with an increase in odds of carpooling by a factor of 1.8 and school bus use by a factor of 2.2.

Across all modes except public transit, a trip *from* school in the afternoon rather than a trip *to* school in the morning was associated with a significant increase in nearly all other travel modes compared with single-family car use, controlling for the other factors. The day of the week, while significant overall and with a few significant associations across modes compared with the reference day of Wednesday, lacks such a discernable trend.

Finally, the family's household vehicle access—operationalized by the number of vehicles per driver in the household—is significantly associated with school trip mode choice. Again logically, living in a household without a car instead of a household with one car per driver (the reference category) was associated with an increase in the odds of carpooling (in this case hitching a ride with a friend or family member), using the school bus, walking, and taking public transit. Students living in a vehicle deficit household (more drivers than vehicles) were also more likely to use the school bus, walk, or take public transit, than they were to use the family car, but significantly *less* likely to carpool with people outside their household.

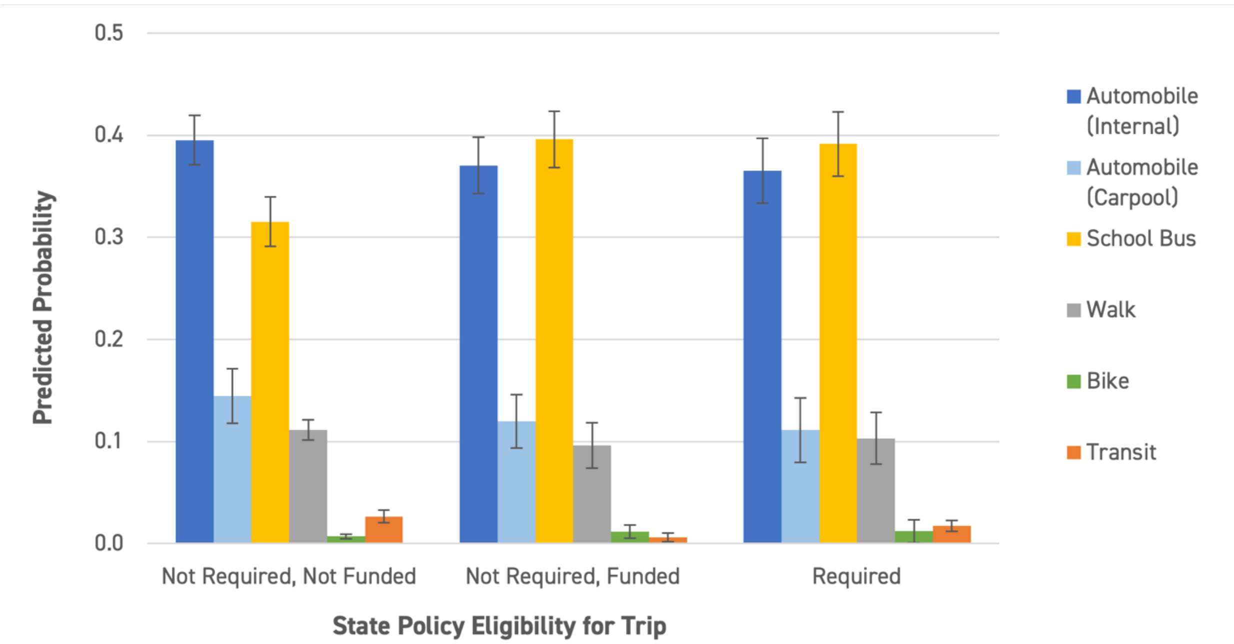
6.3.5. Built Environment Characteristics

Where students live is associated with school travel mode choice, above and beyond the other variables in the model. Living in a major metropolitan area—any core-based statistical area (CBSA)—instead of outside of one was associated with an increase in odds of using the school bus over the family car for a school trip. No other travel mode outcome was significantly explained by the student living in a metropolitan area. There were, however, more substantial relationships when considering a suite of five built environment types: urban, suburban (reference category), second city, small town, and rural. For students traveling for school, living in an urban area or second city instead of a suburb was associated with significantly greater odds of taking the school bus over riding in the family car, while living in a small town or rural area was associated with significantly lower such odds. Public transit functioned basically in reverse: living in an urban area was associated with greater odds of public transit use, while living in a small town or rural area was associated with lower odds. This logic prevails on two fronts. Frequent, high-quality public transit is rare in small towns and rural areas, while school buses provide a key travel option for these students who cannot otherwise drive themselves.

6.4. Discussion

The big takeaway here is that state policy for school transportation matters for student travel to and from school, even after controlling for a wide array of factors shown to affect school trip mode choice in the literature. To what *extent* were these policy variables associated with mode choice? Figure 20 shows the average predicted probabilities across each mode and how they changed across the three policy scenarios, left to right from no state involvement to a student's state requiring that a district provide school bus service for that trip. Average predicted probabilities represent what the model would predict if *all* trips experienced each policy. The error bars represent a 95-percent confidence interval, which help to visualize statistically significant differences both across modes in each policy scenario but also across policy scenarios for a given mode.

Figure 20: Average predicted probabilities of school trip mode selection by state policy eligibility

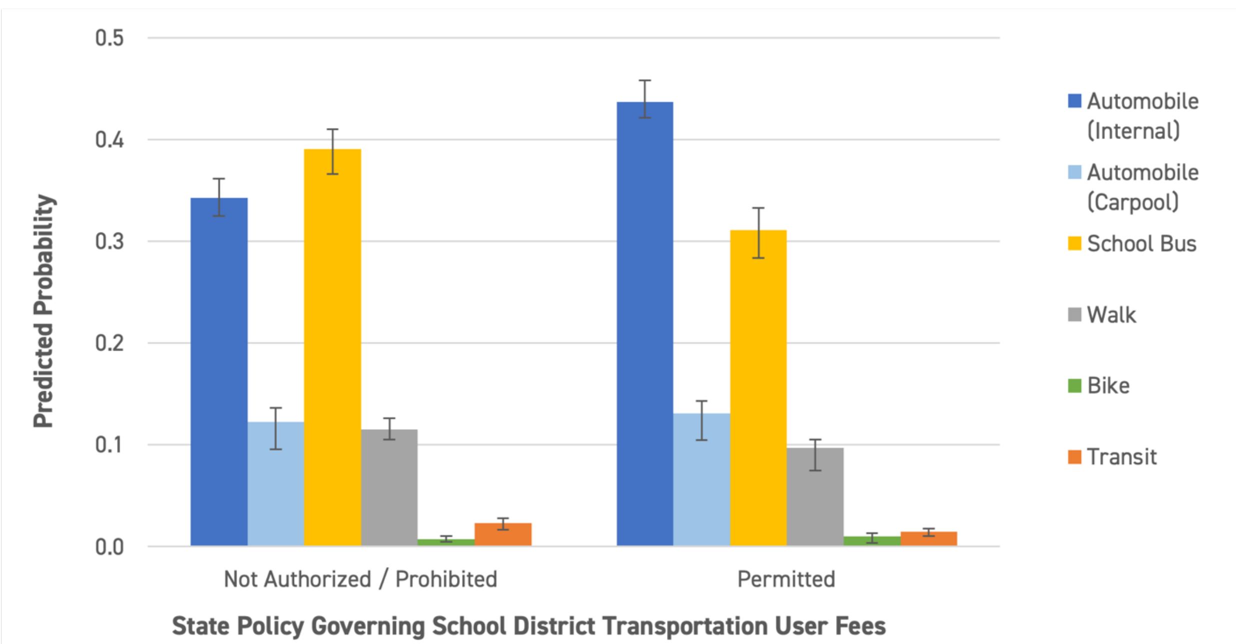


Most notably, and as hypothesized, predicted school bus use increased when states got involved in mandating or funding their use. My model estimates that a child having a trip eligible for state-funded school bus service (e.g., a student living more than two miles from school in Minnesota, or any student living in North Carolina) instead of the trip being ineligible for funding (e.g., that same student living within two miles of school in Minnesota, or any student in Indiana) was associated with an increase in predicted probability from 0.33 to 0.42 of actually riding a school bus, or an increase of 28 percent. However, and perhaps unexpectedly, whether that state involvement was financial or an unfunded mandate on school districts did not significantly change the probability of school bus use; state-required school bus service (e.g., an elementary student living more than 2 miles from school in Massachusetts), instead of having no state school bus support (e.g., that same student in Massachusetts living within 2 miles of school, or older Massachusetts students, or any student in California), was associated with roughly the same numeric increase, to 0.42, in the likelihood of using the school bus.

Predicted automobile use was roughly the inverse; families were less likely to drive their children if states supported district-provided school transportation, either through funding or requirement. As Figure 20 shows, the differences between the three policy regimes across each of the automobile modes (in-household and carpooling) were nearly but not quite statistically significant. However, to test the overall relationship between policy and automobile use generally, I also fit the same model with the in-household automobile and carpool modes combined; this modification did yield a statistically significant difference. Finally, these policies do *not* appear to have meaningfully affected active travel (walking and biking) modes—there was no significant difference in the predicted probability of a student walking or biking to school whether the trip was state-supported or not. Active travel seems to remain central to the short-distance trips, regardless of policy. This result fits with general findings from the travel behavior literature, which suggest that there is distance variation in modal efficacy (Buehler & Pucher, 2023; Scheiner, 2010). Walking is generally most efficient for very short trips, biking for medium-length trips, while motorized travel—cars, buses (school or transit), rail transit—is better for longer trips. In other words, that the predicted probabilities of walking and biking did not change much with changes in state school transportation policy may be capturing the fundamental relative competitiveness of travel modes generally, rather than a school transportation phenomenon.

The changes in predicted modal probabilities with respect to the state authorization of school transportation user fees were similarly strong, as shown in Figure 21. In states where fees are neither authorized nor prohibited, there was no significant difference in the predicted probabilities of the average student using the family car (0.39) or the school bus (0.42) for school travel. However, in states that allowed fees to be charged, these predicted probabilities diverged and became significantly different from one another and from the no-fee environments. A state allowing its districts to charge transportation user fees was associated with an increase in the predicted probability of in-household automobile use from 0.39 to 0.50 (28%) and was in turn associated with a decrease in the predicted probability of school bus use, from 0.42 to 0.31 (26%). Allowing districts to charge transportation fees was *not* associated with significant changes in walking or biking. In short, it appears that—in general—user fees mainly resulted in children shifting from the school bus to the family car. From a policy perspective, it appears that authorizing fees unwinds much of the gains in school bus use and access that state service requirements and funding formulas effect. Spreading the costs of school transportation over the whole tax base, rather than focusing it on the users, leads to greater use of the service.

Figure 21: Average predicted probabilities for mode selection by state policy on student transportation user fees



Three elements of these results have additional implications for planning and policy: the difference between morning and afternoon travel, the role of race/ethnicity, and the role of walking.

First, there are clear differences between morning and afternoon travel, controlling for other characteristics. Morning trips were significantly more likely to happen in family automobiles—which is likely a function of parents dropping off their children at school as part of a work commute. Afternoon trips, in contrast, were more likely to happen by carpool, school bus, walking, or biking. For morning trips, this means more cars on the road during traditional peak hours—88 percent of morning automobile school trips arrived at school between 7:00 and 9:00 AM. So much of transportation planning over the past half-century has been about managing peak-hour, peak-direction travel demand (Downs, 2004; B. Lee et al., 2009). Nudging children onto school buses helps to achieve that goal. Meanwhile, while students typically depart school before the overall afternoon peak travel period, they are more likely to need ways of getting home other than a ride from their parents or caregivers. Ensuring that students have options beyond waiting for an adult to drive them in an automobile should be an important policy goal, because these model results suggest that when such resources are available, students make significant use of them.

Second, while previous studies have found race/ethnicity to be a meaningful predictor of school trip mode choice (see Table 1), this chapter's results, which control for a wide array of factors thought to influence mode choice, found relatively few independent effects of race/ethnicity and school travel. Here, I found only that Black and Latino students were less likely to bike to school, and Asian students were less likely to take public transit—and both these modes have *tiny* shares of the overall number school trips. Other studies found more robust answers here; I have two suggestions for why. First, as I have argued previously (Speroni, 2023), this relationship may vary across different states, particularly in places where Black students make up a greater share of the student population. Prior research that analyzed national data did not find significant relationships between Black students and school trip mode (Kontou et al., 2020; McDonald et al., 2011), but my study of Georgia—where the Black percentage of the population is more than double that of the U.S. overall—found that being Black instead of white was associated with higher odds of school bus use. The travel behavior literature suggests that even controlling for other factors like income, the travel behavior of Black people looks different than travel by people of others races/ethnicities (Giuliano, 2003); perhaps these effects are strongest where the Black population is highest. But second—and perhaps more convincingly—is that school bus service eligibility mediates the relationship between race/ethnicity and school travel. When estimating a restricted version of the models in this chapter that omitted the state policy variables, I found significant associations between students being Black or Latino compared with white, for taking the school bus and for walking. Specifically, being Black instead of white was associated with increased odds of taking the school bus, while being Latino instead of white was associated with decreased odds of taking the school bus or walking. These relationships fall from significance when controlling for state support eligibility. Given this, future research should investigate the variables that predict state support eligibility.

The third element involves policymakers' expectations for student walking. As Table 9 and Table 10 show, 57 percent of state eligibility thresholds across the elementary, middle, and high school categories are two miles or greater—and this does not include the 25 percent that are at 1.5 miles or the 16 states that delegated the responsibility of determining transportation eligibility to local districts. Most statutes call the area inside of those thresholds something like a "walk zone." However, the results of my model suggest this is a misnomer. In fact, walking falls off precipitously after the half-mile threshold. Even for a student living between a half mile and mile from school compared to within a half mile, the odds of walking decrease by 79 percent.[44] Those figures jump to decreases of 90 percent and 96 percent respectively for students 1.0–1.5 and 1.5–2.0 miles away. Of course, several of these students are unlikely to walk because their school district provides them a school bus above and beyond state requirements; a significant relationship for the odds of taking the school bus instead of driving begins at 1.5 miles from

[44] The walking distance beyond which people become increasingly less likely to walk to public transit stops is between 0.25 and 0.5 miles, depending on the frequency and speed of service (Walker, 2012). It is then logical to expect that children walking to school would fall off at a similar threshold, if not a shorter threshold because younger children may have shorter walking capacities and/or their parents may be unwilling to let them walk longer distances due to safety concerns. While an individual's walking distance tolerance will of course vary with other factors like automobile access and physical ability, the commonality is distance as a friction for walking.

home to school and strengthens as distance increases, so they are not *all* instead riding in cars. But state leaders should be under no assumption that students living beyond a half mile can or will walk to school; there are many reasons children and their parents/caregivers decide to eschew walking to school other than distance, including the convenience of the automobile, ensuring children reach school on time, and "stranger danger" (McDonald, 2008a). Such misconceptions about reasonable walking distances only lead to more traffic congestion around schools, especially in the morning peak travel period, which can be avoided by shrinking these "walk zones" down to the zones within which students will *actually* walk.

6.5. Conclusion

This chapter demonstrated that state policies about school transportation have a significant independent association with students' travel behaviors under those various policies. Generous state support for school transportation through mandating service provision and/or funding service—or a lack thereof—has important implications for students, parents and families, schools and school districts, and the environment.

Part 3: California School District Transportation Policies and Travel Behaviors

7. California Policy Design Analysis

The third part of this dissertation tells the story of school transportation policy and school trip travel behavior in California. These two chapters present a story that is *very* different from that of the United States presented in Part 2 above. California provides a useful counterpoint to my national analyses because, unlike most states, school transportation decisions in the Golden State are decentralized and largely delegated to the state's more than 1,000 local school districts. Whereas in Chapter 5 I examine policy variation across states, in this chapter I analyze policy variation within a single state—California—to determine whether similar institutional mechanisms influence policy at a more local scale.

Like my U.S. analysis, this third part of the dissertation culminates in a discrete choice model explaining what predicts students' and families' travel mode selections for school trips, with a focus on the role of institutional factors. As with the U.S. analysis, I focus on a variable I construct to indicate whether a student's trip is eligible for institutionally-provided transportation. But, there are two key differences between my U.S. analysis and this California analysis. The first is conceptual. State policies establish minimums; that is, a state legislature generally sets a baseline for what school districts must do, but these statutes do not *limit* what districts *can* do. District policies, in contrast, are the implementation of these programs. Unless by exception—such as by an appeal process or through federally-guaranteed transportation provision for students with disabilities, students experiencing homelessness, and foster youth—a district's policy determines whether or not the student is offered institutionally-provided transportation.

Second, as I mentioned in Chapter 3, the California data include home and school location, which allow me to determine if a student attends their district-assigned neighborhood zone school, or if they attend a public school of choice or a private school. Recall from the introduction that public schools of choice include charter schools, magnet schools, intra-district choice programs, and inter-district choice programs. For each of these, I only label a student as a public choice program student if they attend a school either with no defined attendance catchment area or if they attend a public school *outside* of their home's assigned attendance catchment area for their respective grade level.[45]

Accordingly, in this chapter and the next I add a focus on what explains districts' policies about setting eligibility policies and a new dimension that considers differences between neighborhood zone school policies and travel, and those for choice programs. Ultimately, my results reveal both of these dimensions to be important.

7.1. Introduction to California Policy Context

In the overview of state school transportation policy designs in Chapter 5, I show that state policies vary widely. Perhaps none was more unusual than that of California. While every state either required school districts to provide transportation to at least some students and/or funds school transportation formulaically, California is one of two states that did not.[46] So, while in other states districts must meet the minimum service levels mandated by their state policies, and can do so using funds provided from the state, California districts are largely left to decide these matters—and fund them—on their own.

Before I go into further detail about the California school transportation policy environment, I begin with disclaimers. I mention in Chapter 5 that California does not have a state school transportation funding formula. There are two caveats to this. First, for the policy as of 2017: while California did not have a state funding formula for transportation, it did allocate *some* state money for school transportation. Beginning in 1947, the California state government covered between 50 and 90 percent of its districts' transportation costs. However, in 1981 state lawmakers froze those funding amounts at the

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[45] Only four percent of students attend a public choice school located inside their district-assigned public school's attendance boundary, based on my analysis of the 2017 NHTS California Add-On combined with the Student Attendance Boundary Survey (SABS).

[46] Indiana is the other state without a mandate or a funding formula. This absence is the result of a 2015 Indiana Supreme Court decision in which a school district sued the state to get out of a requirement to provide school bus transportation amid a local budget crisis (*Hoagland v. Franklin Township Community School Corporation*, 2015). Because Indiana did not fund school bus service at the state level, the district struggled to pay for their transportation program. Ultimately, the court sided with the district and struck down the state transportation mandate.

1981–1982 levels—a byproduct of a state budget squeeze caused by Proposition 13, which limited the property tax revenue that localities could collect across California. The funding amounts remained there until 2008, when the state reduced these amounts by another 20 percent. The 2008 amounts then were in place until 2022 (Kapphahn & Ehlers, 2014). As this chapter shows, these amounts were paltry for those districts that received them. Further, because charter schools were not even invented until the 1990s, these funding amounts did not consider charter schools, meaning charters schools that were not part of a school district that existed before 1982 (e.g., charters authorized by the state or county) would get zero transportation dollars.

The second caveat is that California was the only state to have a major change in policy between 2017 and 2024—it added a funding formula. In 2022–2023, the state revised its school transportation policies with two key new provisions: (1) the state began reimbursing school transportation programs at 60 percent of district costs, and (2) the state prohibited districts from charging user fees to low socioeconomic status students (Ekbatani, 2022). Data are not yet available to consider whether these changes fundamentally changed the extent of transportation services districts offer or how students travel.

However, I believe that studying California's former policy is still instructive. California's 1982–2022 school transportation policy environment—which to some degree amounts to a lack of policy—provides a case study of the response of school districts and students and families in the context of nearly no state intervention. As states face financial cliffs with pandemic funding infusions expiring and costs—especially transportation costs related to fuel and labor—increasing, considering the case of California can help illustrate for lawmakers and policymakers in other states what their school transportation landscape—and the educational access it facilitates—might look like if they were to abandon their policy requirements and funding formulas in hopes of saving cash. Finally, and practically, the 2017 NHTS California Add-On is the last statewide travel survey conducted in California.

In this chapter and the next, I focus on school district transportation policies in the 2016–2017 school year and their downstream relationship to student travel. The district policy dataset for this chapter, which was assembled as part of another project, occurred in Fall 2023, just months after districts were required to submit new transportation plans to the state (Speroni et al., 2025). I found little evidence to suggest that policies changed between the 2016–2017 school year and Fall 2023 based on Internet Archive searches. Where I did find changes, I retained the older data.[47]

7.2. District Policy Design: Service Offerings & Distance Thresholds

I investigate the contours of district transportation policy design by analyzing whether the district offers school transportation service and, if they do, at what distance the district requires that a student must live from their school to receive transportation. For this analysis, I use transportation policy data collected from the sample of 119 California school districts that is approximately representative of the state's 1,002 districts (Speroni et al., 2025). With the availability of more detailed California travel data (used in the next chapter), I consider here the policies for students attending their neighborhood zone schools and students attending public choice school programs, and I analyze both of these at the three general school levels: elementary, middle, and high schools.

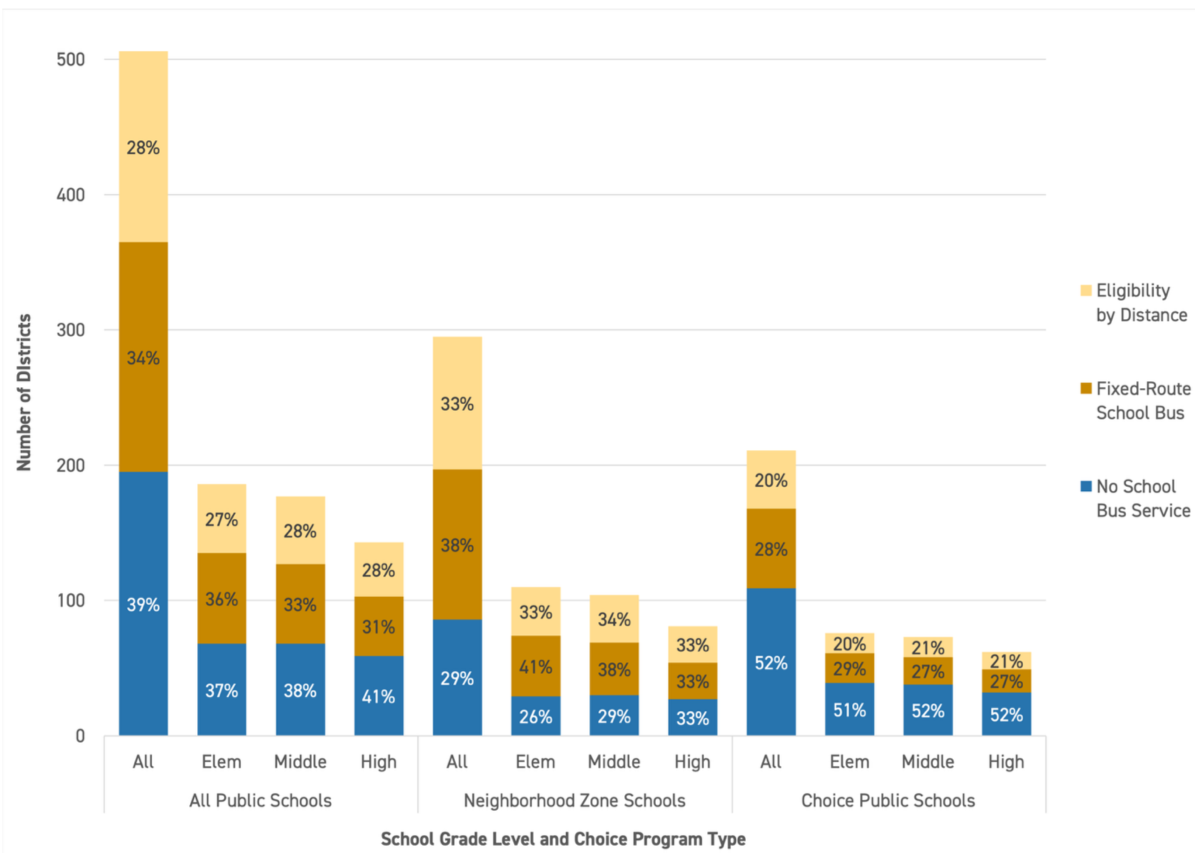
Districts generally fall into three categories: those that offer transportation based on a minimum distance students live from school, those that set bus routes and offer them to their students without a guarantee the bus will be close to them but also without restriction ("fixed-route" programs), and those that do not offer transportation at all. I observe each district up to six times: once each for each school grade level (elementary, middle, and high), for policies about both neighborhood zone schools and choice public schools. Not all districts have all six possible observations; there are 506 observations out of a possible maximum of 714.

The graph in Figure 22 shows the distribution of these categories of school bus service, first with the policies for all public schools on the left, then for all neighborhood zone school policies in the center, and

[47] The only major change we detected was Los Angeles Unified opening its transportation program to all students in the 2023–2024 school year. Previously, only school choice program participants were eligible for transportation if they lived two or more miles (elementary) or five or more miles (middle and high school) from school.

then for all choice public schools on the right. The two shades of gold represent transportation offered in some form, while the blue bars represent no service. The heights of the bars represent the count of districts in each category, while each bar segment is labeled with the percentage of observations within each category. The differences in these heights reflect that there are comparatively more elementary districts overall, and that there are fewer observations for choice school policies because not all districts have school choice programs. Overall, 61 percent of district-level-program observations offer transportation. A slightly lower percentage of districts offer transportation to their zone school high school students. Fewer school districts in the sample offer transportation to their school choice students as compared with what districts offer to zone school students.

Figure 22: School bus service in California school districts by grade level and school choice

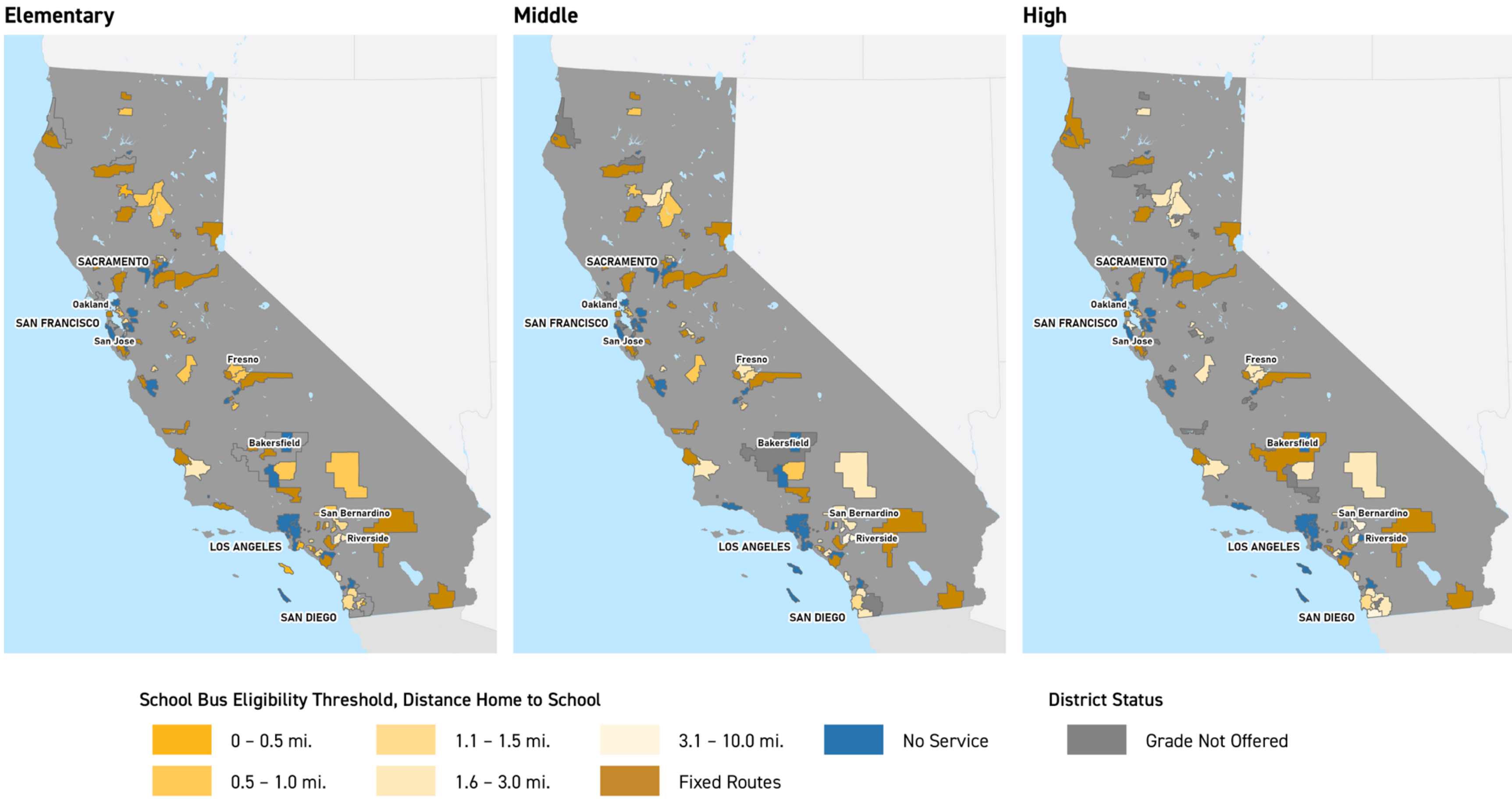


Data Source: California District Transportation Policy Inventory

Figure 23 shows these policies for the sampled school districts across California, as designed for students attending their neighborhood zone schools. Districts that offer service are in varying shades of gold, with darker gold having shorter distance minimums; the light brown districts are those with fixed-route programs. Blue-shaded districts do not offer school bus service. Figure 24 presents a similar map, but these maps present district school transportation policies designed for choice program students. In both figures, the medium-gray-shaded districts are those that do not offer a given grade (e.g., several elementary-only districts in and around Bakersfield do not operate their own high schools but rather feed into high schools in the Kern High district). In the choice program figure, dark-gray shading indicates districts that do not have publicized choice school programs.

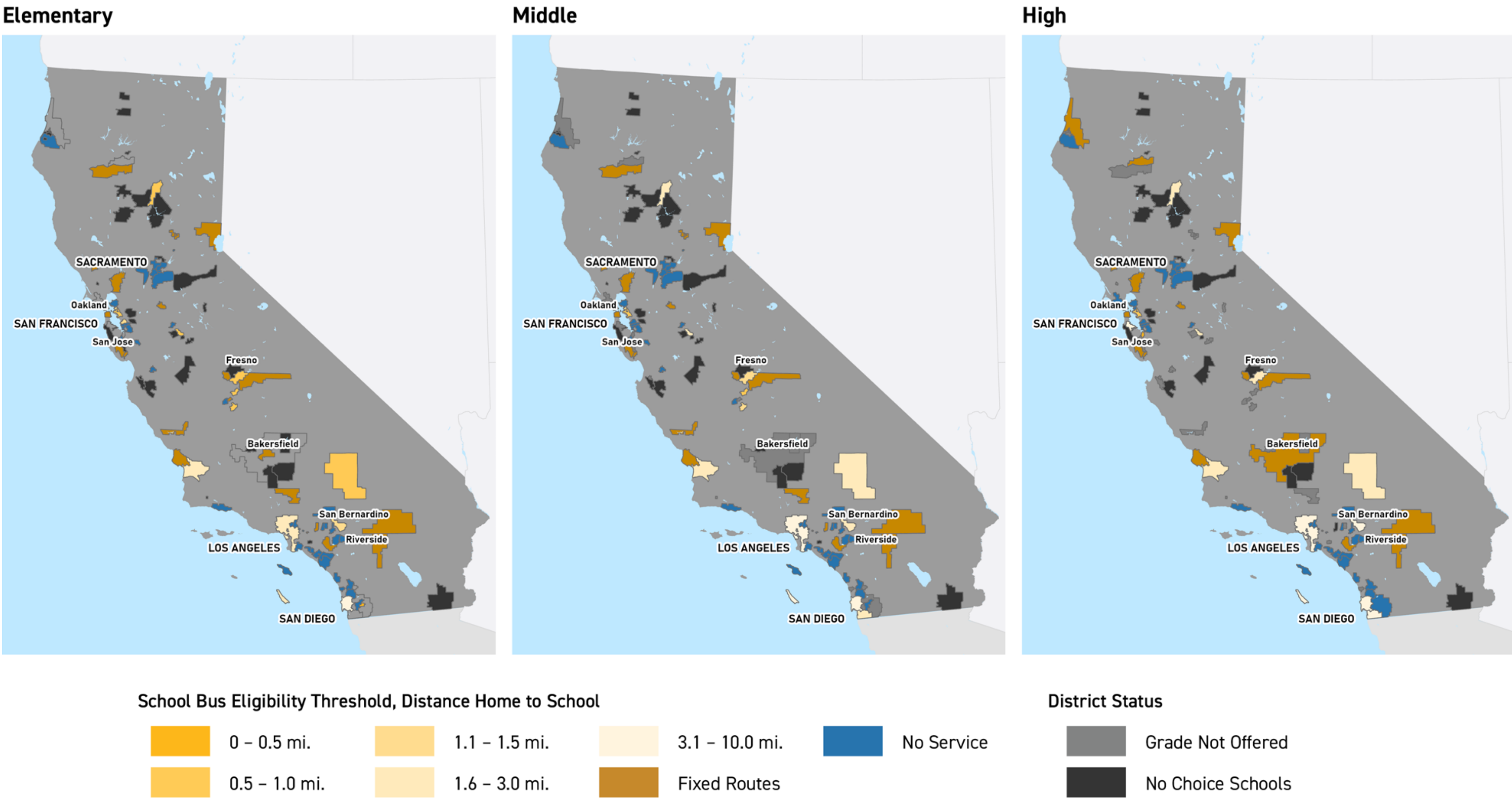
Spatially, the maps highlight three trends in the neighborhood zone school transportation policies. First, there is some spatial clustering of policies. For example, there is a group of districts in the north central part of the state with roughly the same distance-eligible thresholds (between 1.1 and 1.5 miles). Second, districts that do not provide transportation (in blue) are generally in the state's highly urbanized, densely-populated areas, like Los Angeles, the San Francisco Bay Area, and Sacramento. Conversely, most of the state's more sparsely populated areas—the northern part of the state above Sacramento and the deserts in the southeast—mostly offer transportation. And third, there appear to be more darkly-shaded districts for elementary-aged policies and more lightly-shaded districts in the high school map, suggesting that many districts expect older students to secure their own transportation for middle-distance trips.

Figure 23: Maps of California sampled districts transportation policies, for neighborhood zone school students



Data Source: California School District Transportation Policy Inventory

Figure 24: Maps of California sampled school districts transportation policies, for public choice school students



Data Source: California School District Transportation Policy Inventory

In the maps showing choice school programs, there appear to be fewer districts that offer transportation for these students than for neighborhood zone students. Consider the Sacramento area, as well as Orange and San Diego counties in the southwest corner of the state, where most districts appear to provide transportation for neighborhood zone school students but not for choice program students. Additionally, I note that fewer districts appear to have distance thresholds for choice program students as compared with zone school students.

In all, while the maps collectively show pockets of policy consistency, there is still much to be considered about what explains variation in these policies across districts in the state. I turn to this next.

7.3. Explaining District Policy Design

7.3.1. Analytical Framework

I follow the same analytical framework here as I did in the analysis of U.S. state policies in Chapter 5. To consider the motivations and reasons behind school district transportation policy design, I again consider districts' geographic characteristics, fiscal capacities, political ideologies, demographics, and the policies of their neighboring districts. The logic behind each of these remain largely the same as the national analysis (Chapter 5). I summarize those again here.

The basis for these policies lies in the idea that students might live too far from school to walk themselves, and in part because most K–12 students are too young to drive themselves, districts might consider this reason to offer school bus transportation. This concept is more specific here; states might be generally rural or generally urban, but most states are a healthy mix of both. School districts, however, are much smaller geographic units and thus have more uniform built environments than states, which have the potential to vary widely from district to district. To consider this variability, I control for the population density of the school district, rather than the percent of the population living in rural areas as I did for the states. (There are many school districts in California that are decidedly *not* rural, but even the densest states of New Jersey and Rhode Island have rural areas.)

However, even in spite of any perceived need for transportation, student transportation programs are expensive. I consider each district's fiscal capacity to support these programs through two measures: their local source revenues per student, which generally come from property taxes, and the funds they received from the state's Home-to-School Transportation (HTST) Fund. My rationale is that a district may be more likely to provide transportation if the district can raise those revenues locally, rather than pulling from the general state aid it receives. Or, a district may be more likely to offer transportation services if the per-student amount it receives from the state for this purpose is greater. Recall that the amounts California sent to districts for transportation from the HTST Fund did not adjust for student enrollment or students transported (or any other cost factor). This means that the per-student amounts that districts received (based on 1982 total transportation costs) were exogenous to the cost of the service in 2017, giving this variable an almost random relationship to what state funding might do for program implementation.

I also consider the political persuasion of the district. Conceptually, it is possible that districts with more voters in one political party or the other might be more inclined to provide a more robust school transportation service, as they are with other issues inside and outside of education (Gray, 2008; Saiz & Clarke, 2008; Wong & Langevin, 2007). For reasons I mention in the limitations below, I ultimately exclude this variable from the models.

Again like the national analysis, I control for student demographics in the district. Districts might prioritize—or not prioritize—marginalized student populations, like low socioeconomic status (SES) students or students of color. For this, I include the percentage of students in a district who qualify for free- or reduced-price lunch (FRPL) in the models, but I also consider the percentage of students in a district who are Black or Latino. I ultimately find that including SES and not either racial composition variable led to better-fitting models.

Finally, districts' transportation offerings may be spatially correlated with proximate districts. One explanation for this is that districts may compete with one another. There are two mechanisms by which this could happen. First, parents and families may advocate for certain programs and services—like transportation—to their elected school boards and district officials if they see neighboring districts offering such services, which Pacheco (2012) calls the Social Contagion Model.[48] Second, districts may compete with one another for enrolling students—both through families choosing to live in their districts and through school choice programs. School quality, convenience, and services are important components of how families choose their homes—though the relative weights of each vary across income levels and demographics (Cuddy et al., 2020; Fischel, 2004; Lareau, 2014). Further, transportation barriers—including a lack of district-provided transportation—can limit families' abilities to select choice schools outside of their neighborhoods (Gross & Denice, 2017; Jochim et al., 2014; Teske et al., 2009). To account for districts competing with one another in these two ways, I control for the transportation policies of neighboring school districts. However, this is not the only spatial correlation explanation. Such a relationship could be due to common history, common geography, and/or common demography. To explore this, I control for California region as a robustness check.

7.3.2. Limitations

The main limitation of this analysis is the nature of the 119-district sample. This sample considers 12 percent of California school districts, and while the sample is generally representative of all school districts (Speroni et al., 2025), there are many more school transportation programs that are not included in this analysis. Having only 119 districts also limits the number of variables in the logistic regression model and the power of those models to explain policy design. But, data collection is time-consuming and expensive, and this systematic collection of transportation policy data is exceptionally detailed for what it does include—distinct data for all three school-age levels and for public school choice

[48] This actually happened at the state level in California in 2011, when the state proposed eliminating the limited HTST Fund. Parents and families from wildly different school districts—Los Angeles Unified and Death Valley Unified to name two—banded together to convince state lawmakers to rescind their proposed cuts (Watanabe, 2012).

programs beyond just the standard policies for neighborhood-zone school students. This is the only systematically-collected, representative district transportation policy dataset of which I am aware.[49]

The sample also only includes policy data collected in 2023 and verified when possible for consistency with the 2016–2017 school year. Unlike many studies that have considered state policy changes using event history analyses (see Chapter 5), the data here have only one cross-section year. This limits interpretability to how policies differ, rather than how they diffuse. Further, this method cannot imply causality; the relationships I examine in this chapter are associational.

Additionally, there is some conceptual collinearity among the variables included in this analysis, which is a byproduct of school districts being smaller and more internally uniform geographic units than states. Although my diagnostic tests of these variables and models do not indicate any severe statistical collinearity, there are two key conceptual collinearities that alter important results. First, in California, population density, political ideology, and socioeconomic status are related. The denser areas of the state tend to vote for Democrats, as do areas with more low-income households (Baldassare et al., 2025; Shukla & Sumida, 2026). To avoid these relationships, I do not include political ideology in my models; adding either the 2014 gubernatorial election results or the 2016 presidential election results leads to poorer-fitting models based on the results of diagnostic tests I conducted. Second, district local revenues and student socioeconomic status also are related; districts with rich tax bases willing to put those tax revenues toward education tend to have fewer low-income students. I tested models including both variables, but their diagnostic tests performed worse and including both measures diminished significant findings about SES.

[49] Edwards (2022) collected the eligibility distance thresholds for the 50 largest school districts in Michigan, which is the only other similar dataset of which I am aware. In her article, she leverages the largest 50 districts by enrollment—representing about a third of all Michigan districts—because doing so yields the largest sample of students for an analysis of attendance outcomes. While this is advantageous for the purpose of studying student outcomes—particularly those in urban and suburban settings—it does not highlight the full spectrum of districts in policy setting or a full range of travel environments, the aims of this and the subsequent chapter.

7.3.3. Descriptive Statistics of Policy Design

Table 16 provides the descriptive statistics for the 119-district sample of school transportation policies in California. As with the earlier analysis, the outcome variables are at the top. Recall that I include up to six observations per district here (three for each school-age level across both neighborhood zone students and choice school program students). The table includes variables in the forthcoming models, as well as the two variables that I excluded for conceptual collinearity.

Table 16: Descriptive statistics for California school district school transportation policies and characteristics

	Freq.	Pct.	Mean	SD	Min.	Median	Max.
Policy Characteristics							
Transportation Offered	311	61.5%					
Eligibility Threshold (miles)	141	27.9%	1.93	1.47	0	1.50	10
School Level							
Elementary	186	36.8%					
Middle	177	35.0%					
High	143	28.3%					
School Choice Program							
Neighborhood Zone	295	58.3%					
Choice Public	211	41.7%					
Geography							
Pop. Density (100 / sq. mi.)			27.2	32.1	0.1	19.8	186.5
Fiscal Capacity							
District revenue from local sources, per student			$5,208.77	$3,524.14	$639.83	$4,367.73	$20,058.14
State funding to districts for transportation, for student			$86.81	$76.45	$0	$69.34	$694.15
Political Ideology							
Percent Democratic in 2014 Calif. Governor Election			57.3%	16.4%	24.8%	57.3%	95.3%
Demographics							
Percent of Low SES			53.9%	23.4%	2.4%	56.1%	93.1%
Neighbors							
% Neighbors Offering Transport			58.6%	27.9%	0%	60%	100%
Neighbors Elig. Thresh. (mi.)			1.99	0.79	0.75	1.75	4.00

Low SES = Low Socioeconomic Status, measured by the percent of students eligible for free- or reduced-price lunch

Other variables considered: Percent of Black students, Percent of Latino students

Of these 506 district-level-program outcomes, 311 (62%) offer school transportation. Among those that do offer transportation and do so by setting a minimum distance students must live from school to be eligible (141 observations, or 28%), the mean threshold is 1.9 miles, with a minimum of zero miles (i.e., all students receive transportation) and a maximum of 10 miles. Observations are split relatively evenly across the three school-age levels. There are more observations of neighborhood zone school programs than public choice school programs, which tracks with the number of grayed-out districts in Figure 24.

Across the other variables, there is substantial variability. Districts in the sample range from extremely sparsely populated (14 residents per square mile) to highly dense (18,654 residents per square mile). Per-student local tax revenue also ranges from well under $1,000 to over $20,000 per student per year. How can this range exist? School districts with low local tax revenue likely receive greater state aid; providing a quality education is constitutionally required in California (Kemerer, 2013). The socioeconomic composition of districts also ranges from low shares of low-income students (16%) to nearly all students from low-income households (95%). Among neighbors, the average district has just over half its neighbors offering transportation, though the modal district has all its neighbors providing transportation.

Finally, I want to highlight the per-student amount the state provided to districts (at least prior to 2023) through its Home-to-School Transportation (HTST) Fund. The amount ranged from $0 (a charter-only school district and two elementary school districts, which presumably must not have offered transportation in 1982 when the state froze funding amounts) to five low-enrollment districts in the Central Valley of California and its surrounding mountains with over $270 per student. Here, a small drop in enrollment of these districts could lead to increased contemporary per-student funding amounts, since the overall amount remains the same. But even these "larger" amounts by California standards are tiny compared to what students might need. In 2016–2017, the national average per-student transportation expenditure was $1,129 (National Center for Education Statistics, 2017).

7.3.4. Findings

I construct a series of binary logistic regression models and linear regression models to explain district school transportation policy design, including whether the district offers school transportation (logistic) and, among districts that do, what distance threshold students must live beyond to be eligible for district-provided school transportation (linear). The factors that predict district transportation options ultimately determine the travel options available to their students and families.

What explains whether districts provide transportation in California (among my sample districts)? Table 17 presents the results of three models, with two versions of each. Model 1 estimates the probability that districts provide transportation, across all district-level-program units. I estimate two different versions of this model; one that excludes the neighbor policy variable and another that includes it. Without controlling for a district's neighbors, choice school programs are less likely to offer transportation. Districts are 61 percent less likely to offer transportation to choice program students than to their neighborhood zone students, controlling for school age level, population density, state funding, and student SES. However, when I add a control for the percentage of neighboring school districts with transportation policies for the same student age and program type, school choice is no longer statistically significant; instead, having neighboring districts—regardless of choice program type—that offer transportation is associated with a higher probability of a given district offering transportation (about 6% higher). In other words, districts are less likely to offer transportation to choice students, but so too are their neighboring districts. Choice program transportation—or the lack thereof—is a geographic commonality.

Table 17: Predictors of whether a California school district provides school transportation

	Model 1 **All Districts**		***Model 2*** **Neighborhood Zone**		***Model 3*** **Choice Public Schools**	
	Non-Spatial	*Spatial*	*Non-Spatial*	*Spatial*	*Non-Spatial*	*Spatial*
	Coeff. (SE)	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**	**Coeff. (SE)**
School Level						
Elementary	0.117 (0.113)	0.052 (0.132)	0.149 (0.137)	0.093 (0.168)	0.088 (0.121)	0.018 (0.137)
Middle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
High	−0.067 (0.142)	0.082 (0.177)	−0.177 (0.161)	0.041 (0.220)	0.072 (0.179)	0.095 (0.226)
School Choice Program						
Neighborhood Zone	Ref.	Ref.	—	—	—	—
Choice Public	−0.942 *** (0.265)	0.327 (0.325)	—	—	—	—
Geography						
Pop. Density (residents / sq. mi.)	−0.009 (0.142)	0.005 (0.007)	−0.006 (0.007)	0.013 (0.008)	−0.013 (0.015)	−0.004 (0.010)
Fiscal Capacity						
State funding to districts for transportation, per student	0.009 (0.005)	0.008 (0.006)	0.004 (0.005)	0.005 (0.005)	0.019 ** (0.006)	0.018 * (0.007)
Percent of Low SES	0.012 (0.008)	0.002 (0.009)	0.018 * (0.009)	0.004 (0.011)	0.003 (0.011)	−0.003 (0.012)
Neighbors						
% Neighbors Offering Transport	—	0.056 *** (0.009)	—	0.059 *** (0.013)	—	0.057 *** (0.014)
Constant	−0.241 (0.511)	−3.683*** (0.782)	−0.282 (0.549)	−3.943*** (0.961)	−1.253 (0.701)	−3.503*** (0.989)
Model Statistics						
n Districts	506	506	295	211	295	211
Log Likelihood	−295.63	−237.16	−165.20	−131.95	−123.59	−98.04
Prob > χ^2	0.008	0.000	0.113	0.000	0.066	0.000
Pseudo R^2	0.124	0.297	0.072	0.259	0.154	0.329

* P < 0.05 ** P < 0.01 *** P < 0.001

Model form: Logistic regression

Non-Spatial Models = no measure of neighboring district policies
Spatial Models = includes measure of neighboring district policies neighbors

Low SES = Low Socioeconomic Status, measured by the percent of students eligible for free- or reduced-price lunch

Omitted from model: District revenue from local sources, per student; Percent Democratic in 2014 California gubernatorial election. Neither variable was significant in either model and removing them did not meaningfully change other coefficients.

Models 2 and 3 in Table 17 display similar models as Model 1 for neighborhood zone school transportation policies and choice public school policies, respectively. For zone school students, districts are slightly but significantly more likely (2%) to offer transportation. Again, this effect is diminished when I control for what neighboring districts do. For choice students (Model 3), neighboring district policies are again significantly associated with higher odds of districts offering transportation, above and beyond the other controls. However, and notably, districts are more likely to provide transportation for choice students if they receive more transportation funding from the state. Each additional dollar per student from the state's HTST Fund is associated with a two-percent increase in the odds of a district providing transportation for choice students, holding constant the district population density, SES status, and neighboring district policies.

For districts that *do* provide transportation, Table 18 presents results of a linear regression model that predicts district policies on the minimum miles students must live from school to be eligible for school transportation. This is a story of age; in short, the model confirms what the maps in Figure 23 and Figure 24 suggest: districts have lower eligibility thresholds for elementary-aged students and higher thresholds for high-school-aged students, compared with middle school students and controlling for density, funding, and student SES. Specifically, districts making a policy for elementary school students instead of middle school students is associated with about three-quarters of a mile lower in eligibility distance. Meanwhile, a policy aimed at high school students is associated with a roughly two-thirds mile increase in eligibility distance. This model explains about 20 percent of the variation in these threshold distances. However, controlling for the mean eligibility distance among neighboring school districts washes this away and increases the explanatory power of the model to 25 percent. Each additional mile of average distance eligibility threshold among a district's neighboring districts is associated with an added 0.67 miles to the target district's eligibility threshold. Controlling for neighboring district policies, student age level loses its statistical significance.

Table 18: Predictors for California school district transportation eligibility thresholds measured by home-to-school distance (miles)

	Model 4 All Districts	
	Non-Spatial	*Spatial*
	Coeff. (SE)	**Coeff. (SE)**
School Level		
Elementary	–0.772 *** (0.189)	–0.218 (0.240)
Middle	Ref.	Ref.
High	0.649 ** 0.207	0.214 (0.308)
School Choice Program		
Neighborhood Zone	Ref.	Ref.
Choice Public	0.044 (0.895)	–0.042 (0.309)
Geography		
Pop. Density (residents / sq. mi.)	0.007 (0.207)	0.006 (0.007)
Fiscal Capacity		
State funding to districts for transportation, for student	–0.004 (0.003)	–0.003 (0.003)
Demographics		
Percent of Low SES	0.010 (0.008)	0.007 (0.007)
Neighbor Districts		
Average of Neighbor Eligibility Thresholds	—	0.669 * (0.295)
Constant	1.590 * (0.651)	0.326 (0.667)
Model Statistics		
n Districts	141	141
Prob > F	0.000	0.000
R^2	0.199	0.255

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

Model form: Linear regression

Non-Spatial Models = no measure of neighboring district policies
Spatial Models = includes measure of neighboring district policies

Low SES = Low Socioeconomic Status, measured by the percent of students eligible for free- or reduced-price lunch

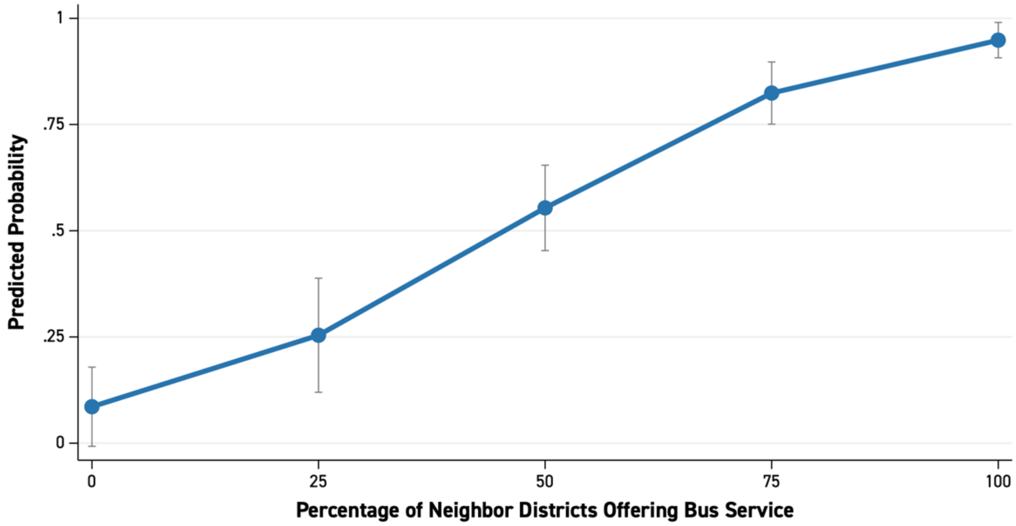
7.3.5. Discussion

Like with the earlier analysis of state policies, I hypothesized that population density would explain whether California school districts provide transportation. Logically, I expected districts to step in where it is more difficult for children to walk to school because their district is sparsely populated and average home-to-school distances were greater. But like my earlier analysis of the states, population density is not significantly associated with California school district transportation offerings.[50]

Although population density does not significantly predict district transportation policies, these policies do not vary randomly. The most consistent explanation for the policies districts have adopted is the policies of their neighbors. Both whether a district offers transportation *and* the minimum distance at which a district requires students to live to be eligible for transportation are associated with what neighbors do for the same age and same choice program type of students. Figure 25 displays the average predicted probabilities across varying percentages of neighboring districts offering school transportation. For a district with four neighbors, holding all else equal, that district going from one neighbor to three neighbors having school bus service increases the predicted probability of offering transportation from 0.25 to 0.82. Differences in predicted probabilities for each one-neighbor increase among four neighbors are all statistically significant, except going from zero to one. The predicted probability of a district offering transportation when all of a district's neighbors have transportation programs is 0.95.

[50] I also considered the possible explanation that school districts could try to offload any obligation for providing transportation onto public transit agencies, where available. To test this, I estimated models that included and/or replaced population density with a proxy for a usable fixed-route, fixed-service general public transit system: the percent of adult commuters who regularly use public transit for their work commutes. My idea was that if adults could use public transit to get to work, so too could students—particularly high school students—for their school trips. However, this variable was not significant and, when added, led to poorer model diagnostic scores.

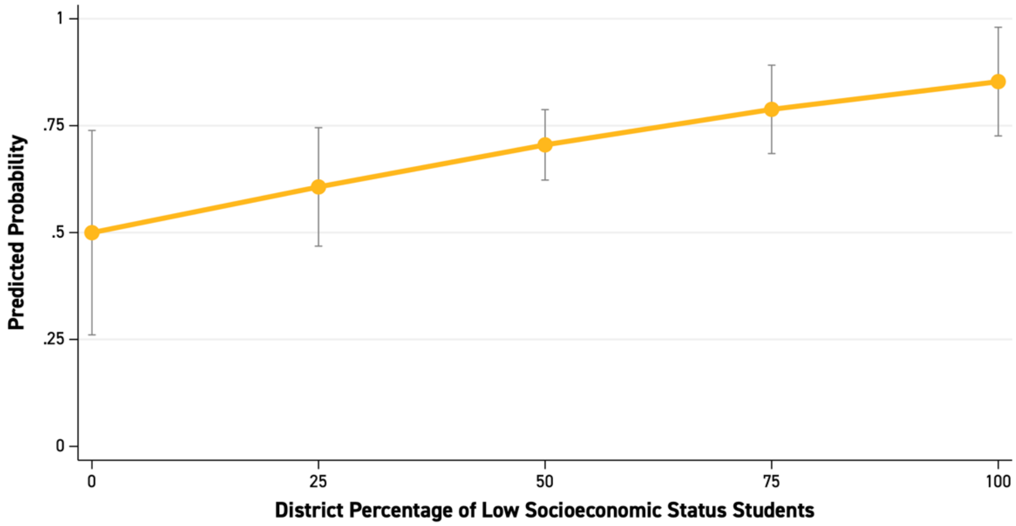
Figure 25: Average predicted probabilities of districts offering school bus service by percent of neighboring districts offering service



Though the policies of neighboring districts are evidently important to districts in determining whether to offer transportation, it is still important to consider the relationships of the other covariates with the outcome measure absent these spatial relationships. Many districts are similar to their neighboring school districts, which can diminish key variations in the outcome across all districts. For example, for district transportation policies governing neighborhood zone school students, before controlling for neighboring district policies, student socioeconomic status was significantly negatively associated with school bus service being offered to students. This finding suggests that, although the effect is modest, districts may see any obligation in providing transportation to students from low-income families, who research has shown tend to have reduced access to automobiles (Blumenberg & Pierce, 2014). Figure 26 illustrates this relationship. A district with only 25 percent of students in poverty has a predicted probability of offering transportation for zone school students of 0.60. Holding everything else constant, a district with three quarters of its students in poverty has a predicted probability of offering transportation to zone school students of 0.79. Although this finding diminishes once I control for the policies of neighboring districts, many low-income districts are located near other low-income districts.

That they act somewhat uniformly in providing transportation to students does not negate that they *do* provide transportation at a higher rate than districts with students from wealthier families.

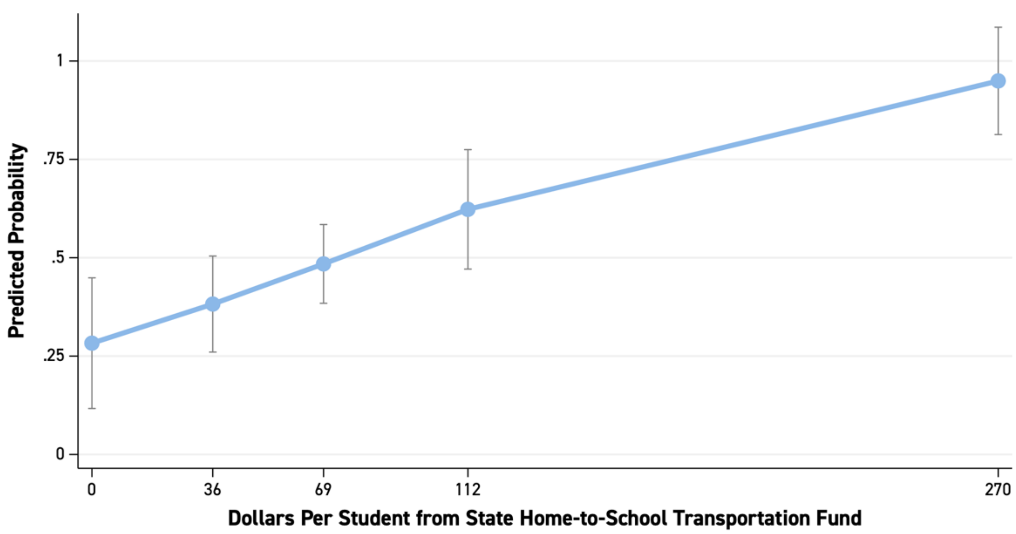
Figure 26: Average predicted probabilities of districts offering school bus service by low SES student percentage, zone school policies only



While the story of neighbor policies and socioeconomic status is consistent with the national analysis, the California data allow for school choice as an added dimension. And ultimately, the results of this analysis suggest that school choice is key to understanding school transportation policies. As I mentioned above, districts are significantly less likely to offer transportation for students enrolled in public school choice programs. In other words, students who attend charter schools, magnet schools, and any other schools outside of their district-assigned neighborhood zone school are less likely to have institutional transportation offered to them, and instead they must rely on their families to transport them—a powerful potential bias against low-income students who might benefit from choice programs but are less likely to have access to private vehicles (Speroni et al., 2026). Further, students at choice schools tend to live farther from school than zone school students (Bierbaum et al., 2020; Gross & Denice, 2017; Singer & Lenhoff, 2025; Speroni et al., 2026). This means that there are critical access implications for school choice programs for students who do not have car access or school bus access.

But the results from Model 3 suggest that this may be solvable. Figure 27 presents the range of predicted probabilities for the per-student dollar amounts of—albeit minimal—state school transportation funding that districts receive, estimated for choice programs (see Model 3 in Table 17). A district receiving an amount of funding from the state at the third quartile ($112 per student) instead of the first quartile ($36 per student) changes the predicted probability of a district offering school transportation to its choice program students from 0.38 to 0.63. So even without a state mandate to require school transportation, these results imply that funding can nudge districts to provide transportation, at least to its choice program students. Future research should track the role of state transportation funding in shaping district transportation offerings for choice school students as California's school transportation funding policies continue to evolve.

Figure 27: Average predicted probabilities of districts offering school bus service by state transportation funding, choice school policies only



Finally, as with the 50-state analysis in Chapter 5, I construct alternative models for policy design that include California regions. Regions can reveal the extent to which proximate districts share common history, geography, and/or demography. Because of the limited sample and the districts within each of the ten California census regions, I consolidate them into three major regions: Greater Los Angeles, the San Francisco Bay Area, and San Diego.[51] The regions were not jointly significant in the overall model with the neighboring district policies variable included and did not change the substantive effects of the other coefficients in the overall model ($\chi^2 = 2.30$, $p = 0.512$).[52] The same is true for the separate models for zone public school policies and choice public school policies, again with the spatial neighbor variables included. Accordingly, I retained the more parsimonious models above in Table 17.

7.4. Linking Policy Design to Student Travel Behavior

Once again, the ulterior motive of this chapter—beyond just explaining variation in California school district transportation policies—is to attach school district policy variables to travel survey data, which I do in the next chapter. As with the national analysis, I merge these policies with student school trips. I do this by determining a student as eligible for a school bus if the student either (A) lives in a district that offers school bus service *and* lives farther from school than the district's eligibility threshold or (B) lives in a district that offers fixed-route school bus service. Beyond the national analysis, I attach the policy to each trip based on the school program type that the student attends: neighborhood zone school or choice public school.

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[51] Greater Los Angeles includes Los Angeles, Orange, Riverside, and San Bernardino counties. The San Francisco Bay Area includes Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, and Solano counties. And Greater San Diego includes Imperial and San Diego counties. The other 45 counties jointly serve as a reference category.

[52] I also considered whether the broader regional context was an explanation for school bus service offerings *without* considering neighboring districts by distance. The region variable is jointly significant in the zone public school model *without* the neighbor district variable ($\chi^2 = 8.60$, $p = 0.035$). Specifically, a district being located in the San Francisco Bay Area instead of outside one of the major regions was associated with 81 percent lower odds (Coefficient = –1.662) of offering school bus service to its students, controlling for school age level, population density, state transportation funding, and student socioeconomic status. This finding dissipates when the neighboring district variable is included. Because neighboring districts for the Bay Area districts are overwhelmingly collocated in the Bay Area, the neighboring district measure likely captures much of the same variation.

Because district eligibility thresholds vary, different students in the same school district—even those who are in the same level of school and in the same type of school program—may have different eligibility for transportation. Take for example two friends who attend a middle school together. They both attend their neighborhood zone school, for which their district sets the minimum school bus eligibility threshold at a mile and a half. These two students live near each other in adjacent neighborhoods. But, the first student lives 1.4 miles from school, while the second student lives 1.6 miles from school. Even though they are nearly neighbors, the first student is now on the hook for walking (or, more likely as I show in the next chapter, being driven) to school, while the second student could take a school bus if they chose. Ultimately, these data and this analysis help set up the core explanation of what factors predict how students and their families choose their school trip travel means.

7.5. Conclusion

This chapter shows that absent a clear directive from the state legislature, California school districts develop a variety of school transportation programs. Although the population density of a school district does not explain this decision, I find that districts' transportation offerings vary depending on school choice program type and student socioeconomic status. Although there are some regional trends toward less school transportation in the San Francisco Bay Area, the story may be about keeping up with the districts next (or almost next) door—even in the Bay Area. As with the 50 states without a coherent national system, California school districts—at least among the 119 in my sample—are also a fragmented collection of district-specific approaches to spatial access to education.

Some California lawmakers have called for a more coherent system, like those in other states. In 2022–2023, the state implemented a relatively new funding formula that will reimburse districts for 60 percent of their transportation costs—should they provide transportation at all. This change may have important implications for choice school students in particular, because as my findings in this chapter suggest, added state funding for transportation is associated with higher odds of districts offering transportation to choice program students. However, it is unclear if this will be enough to nudge districts toward providing more students with transportation—both neighborhood zone and choice school students—especially for a state with a school transportation system that has gradually receded over the past half-century. Perhaps for this reason, lawmakers proposed instituting a state mandate for all California school districts to provide school bus transportation to K–6 students living a half-mile or more from school and students in grades 7–12 living more than a mile from school; however, the bill was subsequently revised to serve a different purpose entirely (Del Castillo, 2022; Mays, 2022).[53] So, as of 2026 there remains no school bus service mandate in California. Ultimately, California's 2016–2017 school transportation policy provides an illustrative example of what happens—both with district policies and, in the next chapter, travel behavior—when a state largely abdicates any responsibility for governing and funding school transportation.

[53] The original draft of the bill, Senate Bill 878 (2022), defined the eligibility distance thresholds I mention above and was titled "School transportation" (Del Castillo, 2022) On revision, the bill shifted its focus to establishing a working group for establishing driver qualifications (Drivers of Unaccompanied Minors: Working Group, 2022). The bill ultimately passed as SB 88 (2023), "Pupil transportation: driver qualifications," which focused on requirements for drivers of school trips and, for the first time, included drivers for small capacity, app-based ridehailing school trip providers in the requirements.

8. California School Travel Mode Choice

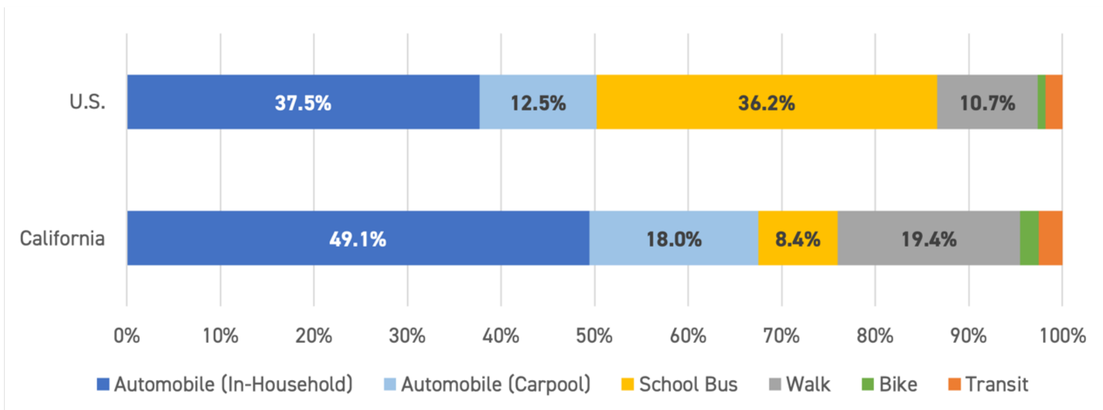
Earlier in the dissertation, I established that state policies about school transportation may have a downstream influence on students' (and their families') decisions about how to get to and from school. Results from Chapter 6 show that state school transportation policies were associated with travel mode choices, above and beyond the relationships prior scholarship already examined: student, parent/caregiver, trip/transportation, and built environment characteristics. But what happens to this relationship in a state where there is *no* state policy? Do individual district policies ascend in importance? Do other, non-policy factors have more influence? This "state-policy-free" school travel environment warrants further inquiry above and beyond the national analysis.

This chapter analyzes school travel in California, where in 2017 the state did not require its school districts to provide school transportation and did not have a funding formula to systematically reimburse districts for transportation costs. I do this in three steps. First, I examine the differences in school travel mode choice between the United States as a whole and California specifically. Second, I calculate the descriptive differences in travel mode split—the percentages of trips taken on each means of transportation—between students eligible and ineligible for district-provided transportation for school trips in California. I also add the type of school program the student attends—their district-assigned neighborhood zone school, a public school of choice (like a charter school, magnet school, or non-assigned public school), or a private school. And third, I estimate another multinomial logistic regression model to predict school travel mode choice across similar variables as the national analysis, with the added specificity of district-level policy being a much closer approximation to the actual options available to the student for their school trips, and with the addition of the student's school program type. I also estimate two additional models leading into the primary model: one that includes only data from the NHTS (for comparison to the national data), and one that adds student's school program type (but does not include the district policy data), the results of which are in Appendix B.

8.1. Descriptive Results

What happens in a state, like California, with minimal support for institutionally provided school transportation? In short, the school bus withers away. Figure 28 shows the distribution of school trips by means of travel. Nationally, more than a third (36%) of students use the school bus. In California, that figure drops to just eight percent. Descriptively, California families largely make up this difference by increased levels of driving, carpooling, and walking. (Biking and transit levels are slightly higher in California, but they still comprise less than four percent of all trips combined.)

Figure 28: School trip mode choice, all school trips, U.S. vs. California, 2017 NHTS



Value labels suppressed for values < 3%.
Data Source: NHTS 2017

Like in the national analysis, California students and families rely more on non-automobile modes from school in the afternoon compared with morning trips to school. As the middle columns of Table 19 show, trips in the afternoon happen slightly more on the school bus, walking, biking, and public transit, while students are more likely to be driven, drive, or carpool in the morning. The right columns of the table present the outcome variables for the model. As I describe in Chapter 3, because the 119-district sample I use in this chapter for policy data is a subset of the existing NHTS sample, I am unable to apply the NHTS person weights to this analysis. I include them in Table 19 for the calculations of all California school trips to demonstrate that the unweighted and weighted samples of all California trips and the unweighted subsample of trips for which I have policy data are all generally similar across the various independent variables.

Table 19: California school trip travel mode to school (morning) and from school (afternoon)

Travel Mode	*All California School Trips*			*Trips Included in California Model **	
	UW Freq.	**UW Pct.**	**W Pct.**	**UW Freq.**	**UW Pct.**
AM Only					
Automobile (In-Household)	1,471	55.6%	52.0%	549	54.4%
Automobile (Carpool)	470	17.8%	17.9%	187	18.5%
School Bus	236	8.9%	8.4%	91	9.0%
Walk	346	13.1%	17.1%	155	15.4%
Bike	70	2.6%	1.6%	27	2.7%
Public Transit*	33	1.3%	2.4%	—	
Other*	21	0.8%	0.7%	—	
Total AM	2,647			1,009	
PM Only					
Automobile (In-Household)	1,205	48.8%	45.5%	442	47.4%
Automobile (Carpool)	432	17.5%	17.8%	162	17.4%
School Bus	268	10.9%	9.2%	105	11.3%
Walk	435	17.6%	22.2%	198	21.2%
Bike	68	2.8%	1.9%	25	2.7%
Public Transit*	41	1.7%	2.8%	—	
Other*	21	0.9%	0.6%	—	
Total PM	2,470			932	
Both AM and PM**					
Automobile (In-Household)	2,676	52.3%	48.9%	991	51.1%
Automobile (Carpool)	902	17.6%	17.8%	349	18.0%
School Bus	504	9.9%	8.8%	196	10.1%
Walk	781	15.3%	19.6%	353	18.2%
Bike	138	2.7%	1.7%	52	2.7%
Public Transit*	74	1.5%	2.6%	—	
Other*	42	0.8%	0.7%	—	
Total	5,117			1,941	

Only includes observations for which there are complete suites of data for the models.

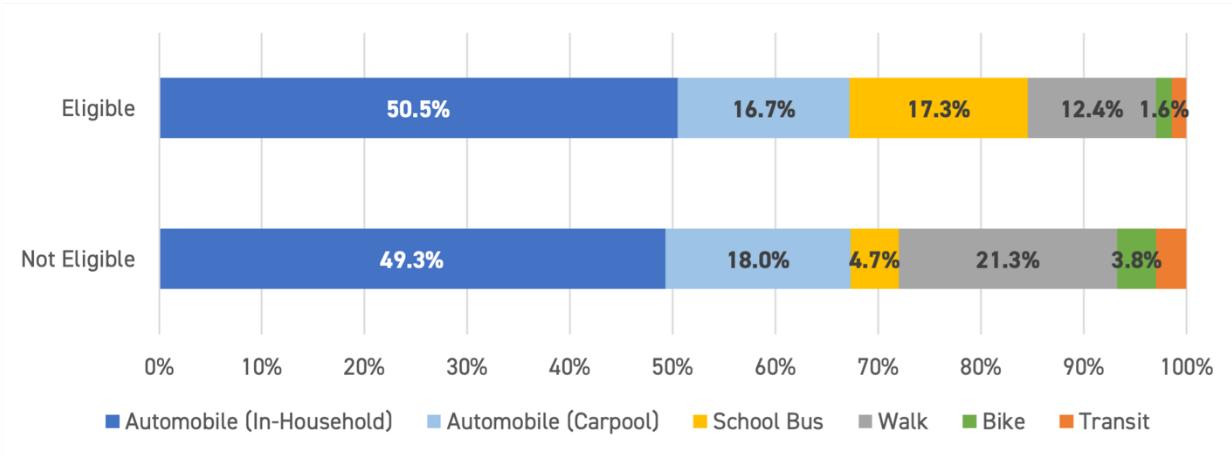
* Transit excluded from model due to sample size limitations; "Other" modes excluded from model due to conceptual ambiguity
** Model outcome variable (automobile modes consolidated, active modes walk and bike consolidated)

Data Source: NHTS California Add-On 2017

Shifting now to my variable of interest, the mode split between students eligible for school bus service and those who are ineligible varies, as shown in Figure 29. Unlike in the national analysis, car use remains relatively constant, both for in-household automobile use and carpooling. For both groups, about half of students drive or are driven in a family car, while just under a fifth carpool. The big difference here is in school bus use and the other modes: walking—and to a lesser extent—biking and public transit. Among students eligible for the school bus, 17 percent use it. This is still substantially below the 36 percent of all American students who are school bus riders and even further below the roughly 45 percent of students who ride the bus when eligible for it by state policy. Among those who are ineligible by school policy, five percent of students ride the school bus. How is this possible? There are two main possibilities. Districts often have an appeals process for students and families to request transportation in situations where they are otherwise ineligible. Families can establish that, for example, the streets on which a student would need to walk to school are not safe. Additionally, federal law requires districts to provide transportation for students who have a disability, are experiencing homelessness, or are foster youth, regardless of whether they are eligible for transportation by district policy.[54]

[54] There are also possibilities of data noise here. I derive my eligibility data from the NHTS, which measures home-to-school distance by calculating the distance from the reported home location to the reported school location over the street network using driving directions. It is possible that school districts calculate their distances by the shortest possible path on the street network, or by straight-line distance. Further, students can have multiple addresses, for example with co-parents who do not live together. The NHTS responding household may not be the home address the school district uses to determine transportation eligibility.

Figure 29: California school trip mode choice by district policy eligibility

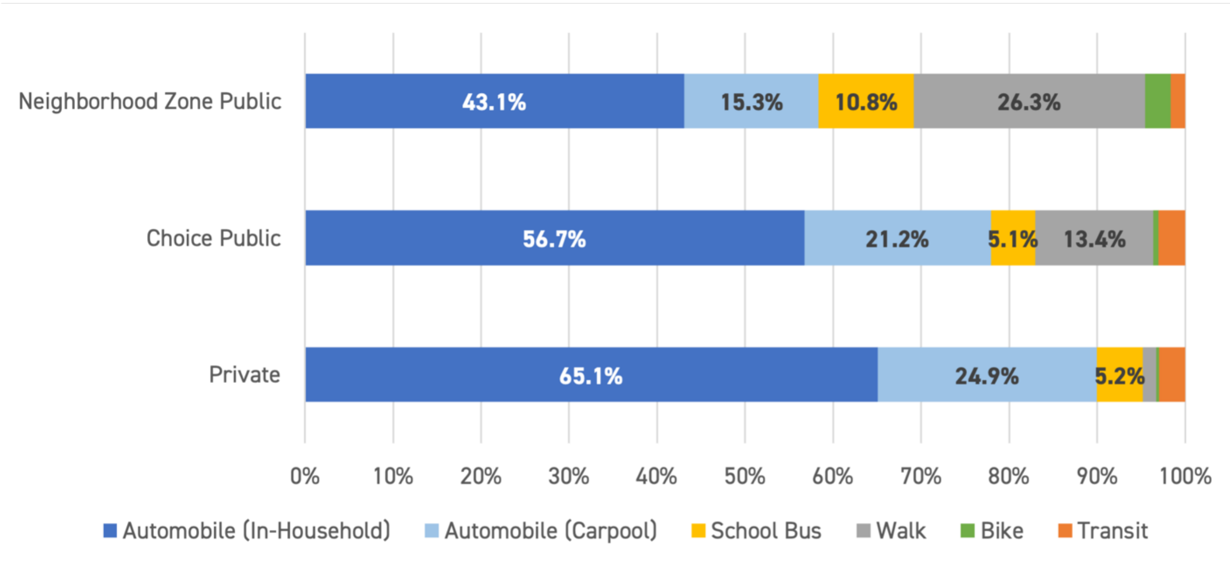


Note: Transit trips included for descriptive purposes only. Not included in model results of this chapter.
Value labels suppressed for values < 3%.
Data Source: NHTS 2017 California Add-On and California School District Transportation Policy Inventory

This chapter adds a new, second variable of interest to the national analysis presented earlier: the type of school a student attends. In Figure 30, I present the shares of school trips that California students take on each travel mode across the three types of schools: neighborhood zone public schools, choice public schools, and private schools. (Note that I exclude private schools from the model, because there is no public policy about private school transportation in California.) Students attending their neighborhood zone school are more likely to travel by school bus, walking, and biking, compared with choice public and—even more so—private school students. Conversely, 58 percent of zone school students drive or are driven in some fashion; that figure increases to 78 percent for public choice school students and 90 percent for private school students. Less than five percent of private school students travel to and from school by means other than an automobile or a school bus.

One additional observation here is that public transit is more common among choice school students. Prior research has suggested this might be true (Denice & Gross, 2018). However, the absolute shares remain small (3% each, versus 1.7% for zone public school students). Even in school-bus-poor California, the shares of school bus use among choice school students exceeded those of public transit.

Figure 30: California school trip mode choice by student school choice program type



Value labels suppressed for values < 3%.
Data Source: NHTS 2017 California Add-On and California School District Transportation Policy Inventory

Table 20 presents the descriptive statistics for the model of school trip mode choice in California. (The outcome variable is in Table 19 in the two right-most columns.) These are unweighted estimates, because they include data from the school district sample that is effectively a subset of the NHTS trip sample. Compared with the national data (see Table 14), the California data have slightly fewer students who are drivers, higher shares of Asian and Latino students and a lower share of white students, and fewer students who live far from school.[55] In this analysis, I also use a variable for built environment type that was constructed differently from the one I used in the national analysis. Using the place types developed by Portland State University to indicate contextual variation in the built environment, the majority of

[55] It is unsurprising that fewer California students live far from school compared to the U.S. on the whole. According to the 2020 U.S. Census, 95 percent of Californians live in urbanized areas, compared with 80 percent of the U.S. population living in urbanized areas (U.S. Census Bureau, 2020).

these trips are taken by students who live in suburban areas, compared with urban and rural areas. (The same is true for the built environments around the students' schools; however, the two measures are too collinear to include both in the models.)

Finally, of the students in the sampled 119 school districts who were also present in the NHTS California Add-On data, 42 percent of their trips were eligible for the school bus, while 58 percent were not. Further, 60 percent of school bus trips are taken in districts that charge user fees.

Table 20: Descriptive statistics for California school trip mode choice analytic sample

	Trips Included in California Model	
Variable	**Unweighted Freq.**	**Unweighted Pct.**
District Policies		
District school bus eligibility		
Not eligible	1,127	58.1%
Eligible	814	41.9%
District transport user fee		
No fee	769	39.6%
Fee	1,172	60.4%
Student		
School level (Age)		
Elementary	980	50.5%
Middle	461	23.8%
High	500	25.8%
Student disability		
No	1,904	98.1%
Yes	37	1.9%
Driver (any age)		
No	1,842	94.9%
Yes	99	5.1%
Race/ethnicity		
Asian	199	10.3%
Black	94	4.8%
Latino/a	516	26.6%
White	909	46.8%
Other	223	11.5%
Caregiver / Household		
Household income		
< $25,000	285	14.7%
$25,000 – $49,999	276	14.2%
$50,000 – $74,999	247	12.7%
$75,000 – $99,999	269	13.9%
$100,000 – $149,999	448	23.1%
$150,000 – $199,999	211	10.9%
≥ $200,000	205	10.6%

Variable	Trips Included in California Model	
	Unweighted Freq.	Unweighted Pct.
Chose home: Convenient to school		
No	1,452	74.8%
Yes	489	25.2%
Chose home: School system		
No	1,237	63.7%
Yes	704	36.3%
Parent with college degree (1+)		
No	737	38.0%
Yes	1,204	62.0%
Trip / Transportation		
Distance home-to-school (miles)		
<0.5 mi.	193	9.9%
0.5–0.99 mi.	404	20.8%
1.0–1.49 mi.	274	14.1%
1.5–1.99 mi.	214	11.0%
2.0–2.99 mi.	291	15.0%
3.0–4.99 mi.	222	11.4%
≥5 mi.	343	17.7%
Trip time		
AM	1,009	52.0%
PM	932	48.0%
Trip season		
Fall	806	41.5%
Winter	572	29.5%
Spring	563	29.0%
Household vehicle status		
Zero vehicles	27	1.4%
Vehicle deficit	187	9.6%
Vehicle+ per driver	1,727	89.0%
School Characteristics		
School program type		
Neighborhood zone	1,225	63.1%
Public choice	716	36.9%
Built Environment		
California metro area		
Not in major metro	596	30.7%
San Joaquin Valley	190	9.8%
Greater Los Angeles	341	17.6%
Sacramento	323	16.6%
San Diego	293	15.1%
San Francisco Bay Area	198	10.2%
Neighborhood type (Urbanicity)		
Urban	96	5.0%
Suburban	1,649	85.0%
Rural or Small Town	196	10.1%

n = 1,941

8.2. Limitations

Most importantly, this chapter's analysis solves most of the limitations that were present in the national analysis (Chapter 6). The model presented in the next section controls for residential self-selection and school choice. Its policy variables are also much closer to an individual student traveler's actual situation, because they reflect district policy implementation rather than just policy minimums that states impose. But nevertheless, there are of course limitations to this analysis.

Most of the limitations here stem from the small sample size. Because the NHTS California Add-On is a subset of the larger NHTS sample, the data are already inherently limited in size. I am further restricted by the number of school districts in the sample of district transportation policies. This forces three issues. First, it makes detecting significant effects more difficult; there is less variability than there would be if I either had all students from all 1,002 of the state's school districts in the NHTS data or district policy data for all 616 districts with schools that the NHTS participant students attended. It also necessitated making decisions about which control variables to include for parsimony, because the limiting factor was a relatively small number of school bus trip observations. Second, because the 119-district sample is a subset of the 616 with schools that the NHTS participant students attended, it removes my ability to use the NHTS person weights for descriptive statistics. Studies in the school travel mode choice literature typically employ weights only for descriptive statistics but have not typically weighted mode choice models (Ewing et al., 2004; S. He, 2011; Kontou et al., 2020; McDonald et al., 2011).[56] And third, the small sample size forces me to exclude the public transit mode. While this mode is small, there

[56] The NHTS weights serve two purposes: (1) to correct for differences between respondents and non-respondents and (2) to correct for the survey's intentionally disproportionate design so that the survey respondents are made representative of the population. In a departure from the literature, I weighted the U.S. national school trip mode choice model in Chapter 6 to correct for an oversampling of specific policy regimes in the ten states that had add-on samples in the NHTS—additionally important because the trip's exposures to state policy environments were the variables of interest. In the case of this chapter, both the California Add-On and the sample of school districts are stratified random samples and are not subject to extreme oversampling that affect the variable of interest. In the national analysis, I was concerned with the substantially greater observations from California and Texas in particular. Here, the chances of a student's trips appearing in the modeled sample remain substantially closer to random than in the national model with large state oversamples. While it would have been ideal to use the weights here, it was not possible due to the exclusion of trips not in the 119 sampled school districts.

are nonetheless potential roles for public transit in school travel, especially for unusual trips like a trip home from after-school tutoring. This limitation applies mostly for older children who can use public transit unescorted.

There are three other limitations not related to sample size. First, in the collection of district policy data, many districts only employ fixed-route school bus service—or at least only publicly report fixed routes. I considered a survey of district school transportation supervisors to gain clarity on these policies. Does the district have an underlying threshold by which they determine the students to serve in setting routes? However, I eschewed this approach because it would have been labor intensive and likely suffered from a low response rate, potentially complicating and/or eliminating the eligibility data—particularly worrisome for large enrollment districts where a non-response to such a survey could have eliminated dozens of student trip observations. Second, like the national data, I rely on student disability status data from the NHTS, which covers only disabilities that affect physical mobility. School district data on individualized education program (IEP) participation would be a clearer indication of student disability and, in turn, eligibility for transportation because of disability. Third, and finally, while this model is a much more accurate representation of the school transportation programs students actually experienced, the results of this chapter are associational and not causal.

8.3. Model Results

I present the results of the school travel mode choice multinomial logistic regression model for trips taken by students living in the sampled California school districts in Table 21. This is a condensed outcome variable for travel mode: automobile (in-household or carpool), school bus, and the active travel modes (walk and bike). The reference travel mode is the automobile. As with the national model in Section 6.3, I describe the results of each vector of variables, first covering the overall significance of the variables using Wald tests and then describing the individual coefficients for each categorical variable.

Table 21: Predictors of school trip mode choice among students in California sampled school districts

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
District Policies								
District school bus eligibility	0.000	***						
Not eligible			Ref			Ref		
Eligible			0.912	**	0.002	-0.557	*	0.021
District transport user fee	0.811							
No fee			Ref			Ref		
Fee			-0.139		0.579	-0.078		0.697
Student								
School level (Age)	0.000	***						
Elementary			Ref			Ref		
Middle			0.814	**	0.009	1.339	***	0.000
High			0.101		0.755	1.792	***	0.000
Student disability	0.000	***						
No			Ref			Ref		
Yes			1.869	**	0.008	-4.174	***	0.000
Driver (any age)	0.015	*						
No			Ref			Ref		
Yes			-1.442		0.195	-1.523	**	0.008
Race/ethnicity	0.013	*						
Asian			-1.050	*	0.045	-0.381		0.256
Black			0.118		0.833	0.771	*	0.049
Latino/a			-0.274		0.373	0.247		0.300
White			Ref			Ref		
Other			-0.210		0.615	-0.868	**	0.008
Caregiver / Household								
Household income	0.000	***						
< $25,000			1.628	**	0.002	0.454		0.194
$25,000 – $49,999			0.787		0.131	0.393		0.236
$50,000 – $74,999			0.558		0.315	-0.041		0.907
$75,000 – $99,999			Ref			Ref		
$100,000 – $149,999			0.579		0.249	1.202	***	0.000
$150,000 – $199,999			-0.454		0.593	0.113		0.763
≥ $200,000			1.469	*	0.011	0.014		0.972
Chose home: Convenient to school	0.000	***						
No			Ref			Ref		
Yes			0.092		0.753	0.777	***	0.000
Chose home: School system	0.033	*						
No			Ref			Ref		
Yes			0.737	*	0.012	0.195		0.330
Parent with college degree (1+)	0.002	**						
No			Ref			Ref		
Yes			-1.094	**	0.001	-0.259		0.257
Trip / Transportation								
Distance home-to-school (miles)	0.000	***						
<0.5 mi.			Ref			Ref		
0.5–0.99 mi.			0.962		0.381	-2.169	***	0.000
1.0–1.49 mi.			0.891		0.426	-3.069	***	0.000
1.5–1.99 mi.			1.484		0.184	-4.014	***	0.000

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
2.0–2.99 mi.			1.105		0.326	-4.447	***	0.000
3.0–4.99 mi.			2.012		0.070	-4.656	***	0.000
≥5 mi.			2.097		0.062	-4.588	***	0.000
Trip time	0.000	***						
AM			Ref			Ref		
PM			0.373	**	0.001	0.601	***	0.000
Trip season	0.091							
Fall			Ref			Ref		
Winter			0.213		0.455	-0.550	*	0.010
Spring			0.169		0.575	-0.145		0.505
Household vehicle status	0.047	*						
Zero vehicles			2.069	**	0.009	1.891	*	0.033
Vehicle deficit			0.165		0.713	0.396		0.203
Vehicle+ per driver			Ref			Ref		
School Characteristics								
School program type	0.001	***						
Neighborhood zone			Ref			Ref		
Public choice			-0.779	*	0.013	-0.625	**	0.004
Built Environment								
California metro area	0.001	**						
Not in major metro			Ref			Ref		
San Joaquin Valley			0.144		0.669	0.518		0.130
Greater Los Angeles			-0.183		0.666	-0.712	*	0.031
Sacramento			-1.261	**	0.007	0.474		0.116
San Diego			-1.247	*	0.015	0.111		0.736
San Francisco Bay Area			-0.066		0.898	-0.032		0.930
Neighborhood type (Urbanicity)	0.000	***						
Urban			-1.164		0.124	0.972	**	0.004
Suburban			Ref			Ref		
Rural or Small town			1.167	***	0.000	-0.970		0.065
Constant			-4.440	***	0.000	1.693	***	0.000

n = 1,941 * $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

Standard errors clustered by individual to account for AM and PM trips for each student.

Reference mode: Automobile (In-Household & Carpool combined)

Model form: Multinomial logistic regression

Omitted from model for parsimony: Gender, Siblings, Household structure, Homeownership, Foreign-born parent (1+), Parent medical condition (1+), Parent flexible schedule (1+), Travel day of week, Walkability, High-quality transit access

I test the hypothesis that school district transportation policy and/or the type of school in which a student is enrolled are significantly associated with school trip mode choice. The table presents results using log odds coefficients, while in the narrative, I describe these by explaining the change in the odds (the exponentiation of the log odds, or the relative risk ratio). As a robustness check, I estimated an additional version of the model with standard errors clustered by school district (rather than by student). There were no meaningful changes in significance levels. Because most individuals appear twice in the model with identical predictors other than outcome travel mode and trip time, I retain the version of the model with standard errors clustered by student.

8.3.1. District Transportation Policy

First, sampled district school transportation policies play a significant role in predicting school trip travel mode choice. A student being eligible for a school bus instead of being ineligible by district policy was associated with a roughly 2.5-fold increase in the odds of using that school bus. However, such eligibility was associated with a reverse effect on walking/biking; being eligible for a district-provided school bus was associated with lower odds of active travel (45% lower).

Unlike in the national data, trips taken in school districts that charge transportation user fees had no significant association with travel mode selection.

8.3.2. Student Characteristics

Across the student characteristics, school level, student disability, driver's licensure, and race/ethnicity are significantly associated with school travel mode choice in California overall, controlling for all other factors. Student sex and number of siblings are not significant and thus I remove them from the model for parsimony and to retain degrees of freedom.

Specifically, a trip taken by a middle school student as opposed to an elementary school student is associated with multiplying the odds of taking the school bus instead of an automobile by a factor of 2.3. Similarly, older students were more likely to walk than drive. Middle school trips were associated with multiplying the odds of walking/biking versus driving by 3.8—that factor rises to 6.0 for high school students compared with elementary school students.

Trips taken by students with disabilities were significantly more likely to happen on a school bus than in an automobile. A trip taken by a student with a mobility impairment was associated with 6.5

times higher odds of being a school bus rider. Conversely, walking/biking trips taken by students with disabilities were exceedingly (and logically) rare.

While, nationally, students tend to abandon the school bus when they obtain driver's licenses, that is not the case in California. However, licensed drivers are significantly less likely to walk or bike to and from school. Trips taken by those with driver's licenses, controlling for school level (a proxy for age), trip distance, and other factors, were associated with reducing the odds of walking/biking compared to riding in an automobile by roughly 78 percent.

Finally, student race and ethnicity were significantly associated with school bus use, but the specific relationships were limited for students of color relative to white students. Being Asian instead of white was associated with lower odds of taking the school bus; other races/ethnicities were not significantly different from white students, all else equal. For walking, being Black instead of white was associated with higher odds of walking/biking, while being two or more races and/or a race/ethnicity other than Asian, Black, Latino, or white was associated with lower odds of walking/biking instead of driving.

8.3.3. Caregiver/Household Characteristics

Parent/caregiver and household characteristics are significantly associated with school trip mode choice. While household income is overall significant based on the results of a Wald test, there are only three significant relationships comparing categories with the middle-income category of $75,000 to $99,999. Being in the poorest or the wealthiest income groups, compared with being in the middle-income group, is associated with higher odds of using the school bus. Meanwhile, students from families who earn between $100,000 and $149,999 annually are more likely to walk or bike to school; this was associated with an increase in the odds of walking/biking by a factor of 3.3. Although higher-income status was associated with more school bus use, parental educational attainment—often associated with income—was associated with lower odds of school bus use.

The notable additions to this vector for the California analysis are the two variables that indicate why families chose their homes. A trip taken by a student from a family who chose their home because of the school system (i.e., the school quality and services offered), as opposed to a family who did not report the school system as a reason for selecting their home, was associated with 2.1 times higher odds of traveling by school bus than by car. Similarly, a trip taken by a student from a family who chose their home because it was convenient to school was associated with 2.2 times higher odds of walking, compared to a trip taken by a student in a family who did not list convenience to school as a reason for moving to their current home. In addition to these insights, these variables help control for residential self-selection in mode choice. For example, the convenience to school indicator helps explain that a student is more likely to walk to school because their parents selected the family home so the student could walk/bike, not necessarily because they selected walking/biking independently. However, the statistical significance of other factors that explain walking, while still controlling for convenience to school, suggest that choice in housing location is not the *only* determinant of walking to school.

8.3.4. Trip Characteristics

Distance from home to school, trip time and direction, trip season, and household vehicle resources are all significantly associated with school travel mode choice in California. Notably, the walkability of a student's home neighborhood was *not* significantly associated with walking/biking (or any other mode) independent of distance to school.

Like the national model, distance to school was negatively associated with walking/biking to school. As distance increases, the odds of walking decrease. In California, as in the nation, there is a substantial drop-off in odds between the reference category of a half-mile or less from home to school to even the next-nearest category of 0.5 to 1.0 miles: this difference is associated with 89 percent lower odds in walking/biking. This dynamic persists up to trips between 3 and 4.9 miles from home to school, which compared with trips of less than a half-mile are associated with 99 percent lower odds in walking.

The model results also support the descriptive finding that afternoon trips are more likely to occur on modes other than the automobile. Trips in the afternoon instead of the morning were significantly associated with higher odds of traveling by school bus or by walking/biking. Winter, instead of fall, was associated with less walking. (Although much of California has ideal weather year-round, three in ten trips in the survey occurred outside of California's major metropolitan areas, several of which experience cold and snowy winters.) Finally, trips taken by students in households without automobiles, compared with trips by students in households with at least one vehicle per driver, were significantly associated with more use of the school bus and walking/biking, compared with automobile use.

8.3.5. Built Environment Characteristics

Findings for the built environment that school trips occur in are intuitive. A trip occurring in an urban area instead of a suburban area was associated with higher odds of walking/biking (2.6-fold increase). Meanwhile, a trip occurring in a rural area instead of a suburb was associated with an increase in the odds of riding in a school bus instead of driving or being driven by a factor of 3.2.

For the metro areas, only the Greater Los Angeles, Sacramento, and San Diego metropolitan areas are significantly different from trips taken in non-metropolitan areas of California. Trips taken in the latter two of these regions are less likely to occur on a school bus, while Los Angeles school trips are less likely to be walking/biking trips than driving trips. This finding about Los Angeles is noteworthy because Los Angeles is the second-largest region in the country by population, has nearly ideal weather, and (to the surprise of many) is the most densely populated urbanized area in the U.S.

8.3.6. School Characteristics

With respect to choice schools and school trip travel mode, trips taken by students who attend public schools of choice (e.g., charter schools, magnet schools, etc.) were associated with lower odds of school bus use—controlling for school bus eligibility—and lower odds of walking, compared to those attending neighborhood zone schools. Specifically, being a school choice program participant was associated with 54 percent lower odds of using a school bus versus an automobile, while was associated with 50 percent lower odds of walking versus riding in an automobile. As in the descriptive statistics, students enrolled in and traveling to and from public choice schools were much more likely to be driven or drive in cars.

8.3.7. Additional Models

I estimate two additional models: one that predicts travel mode solely based on the NHTS data, which helps to facilitate comparison with the national NHTS (no school or district characteristics), and one that predicts travel mode controlling for school program type but not eligibility. I present the results of both models in Appendix B.

In both models that do not control for eligibility, distance is significantly associated with school bus use. However, controlling for eligibility supersedes this relationship. Similarly, the major metropolitan areas outside of the San Joaquin Valley (Bakersfield and Fresno) are associated with lower odds of school bus use without controlling for eligibility, suggesting that there are regional trends in which students are eligible. Students may be more likely to use the school bus in non-metropolitan areas (or the San Joaquin Valley metros), but they may also be more likely to be eligible for school bus service there. Students in Los Angeles and the Bay Area are just as likely to use the school bus, when offered, as students in non-metropolitan areas, Bakersfield, and Fresno.

The first alternative model, which controls for neither school choice type nor school bus eligibility, shows a significant relationship between income and school bus use with clearer socioeconomic equity implications than what the primary model in Table 21 reveals: a trip taken by a student in the lowest *three* income categories (under $75,000 collectively) was positively associated with the probability of school bus use. However, only the lowest single income category is significant once I control for school choice. This finding suggests that students in the low-middle income groups ($25,000 to $74,999 collectively) may use the school bus to access those choice schools.

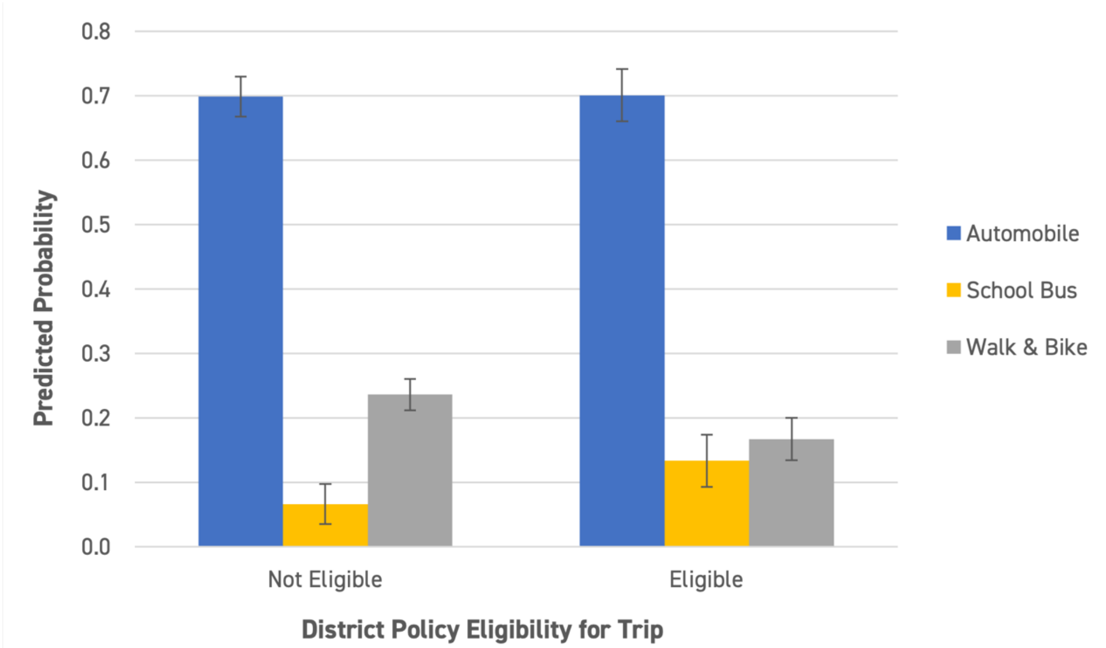
The second alternative model confirms the descriptive statistics for school choice type: both public choice school and private school enrollment are associated overall with lower odds of school bus use and walking/biking. Note that once I control for district policy, I am unable to include private school observations because California public policy does not govern private school transportation eligibility. Most other relationships remain unchanged as compared with the main model.

8.4. Discussion

At the local level, as with the state level effects shown in the national models, institutional factors are meaningfully associated with how students and families travel to school. Specifically, students who are eligible for school bus service are more likely to use that service, while choice school program students—controlling for eligibility—are generally car users.

Figure 31 presents predicted probabilities of school trip mode by my primary variable of interest: eligibility for the school bus. On the one hand, automobile use for both trips that were bus-eligible and trips that were not have a predicted probability of 0.7. On the other hand, eligible trips were more likely to use the school bus, but they were also less likely to be walk/bike trips.

Figure 31: Average predicted probabilities of California school trip mode selection by district policy eligibility



Planners might be tempted to look at this trend as alarming. With statewide goals of reducing vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions, California state officials might look at the above figure and think, why would we advocate for school bus transportation—both in terms of policy and finance—when it would seem to contribute little to the state's transportation and environmental goals? I suggest instead that planners and policymakers consider the two different purposes for general public transit: (1) as a means of moving many people in dense areas without sufficient road capacity and parking, and (2) as a social service for those without other mobility options (Taylor & Morris, 2015). I believe these results point toward the school bus as serving the latter purpose, which indicates an important equity role in providing access to education. The main model (Table 21) controls for distance from home to school, which is also a factor in determining eligibility. This all suggests that the students whom the model predicts would flip from walking/biking to taking the school bus are not those who *choose* to walk or bike, but rather those who walk or bike out of need, perhaps even out of desperation.

There are clear income and distance implications in the descriptive data when disaggregated by mode choice. Table 22 shows the median home-to-school distance, average household income, and average household vehicles per driver for the three mode categories in this chapter's principal model: automobile, school bus, and walking/biking. On average, walkers/bikers are from poorer families than car users; school bus users are poorer still, on average. It appears that, at least to some extent, walking is for lower-income students who live close to school, school buses are for lower-income students who live far from school, and cars are for everyone else. Interestingly, the number of vehicles per driver in a student's household is relatively consistent, though slightly lower for walkers/bikers.

Table 22: Key descriptive statistics for California students/households by school trip travel mode

Mode	Average Home-to-School Distance (mi.)	Average Household Income*	Average Household Vehicles per Driver
Automobile	3.2	$104,078	1.14
School Bus	4.9	$76,505	1.20
Walk/Bike	1.1	$90,815	1.11

n = 1,941 trips

* The NHTS reports income categorically. To estimate, I calculate the average of category midpoints.

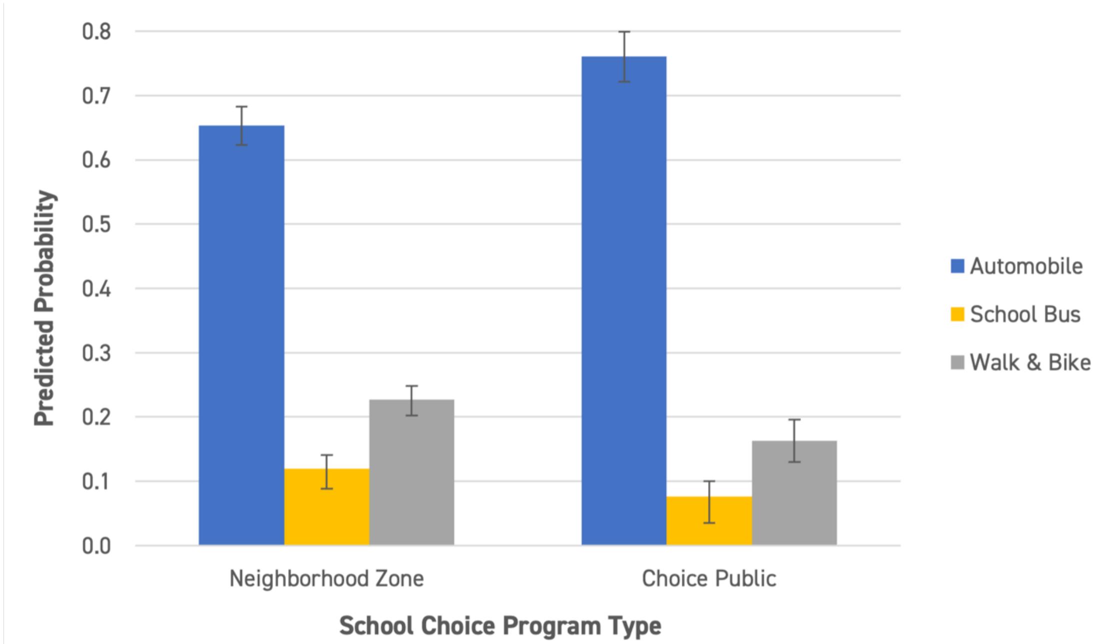
Data Source: NHTS 2017 California Add-On and California School District Transportation Policy Inventory

Some of these students who are walking are worth serving by providing a means of transportation that may be more time-efficient and expose them less to harmful road environments than walking. Walking to school, particularly for wealthy students whose parents chose their homes to be convenient to school, can be an excellent form of exercise and provide children with additional autonomy as they age. But for students who walk because they have no other choice, they may face less-ideal environments on their walks, ranging from a lack of sidewalks, crossing major arterial streets, walking in darkness, bullying, and crime (Burdick-Will et al., 2019). School buses offer some protection from these harms.

School choice enrollment is again a different story. Choice students are more likely to be driven or drive, and less likely to walk, all else equal. The predicted probabilities of this relationship are shown in

Figure 32. The average predicted probability of a neighborhood zone school student in California traveling to school by car is 0.65. That significantly jumps to 0.76 for students attending choice public schools. The probabilities for choice program students—again controlling for school bus eligibility and distance from home to school—drop nearly in half for school bus use (0.12 to 0.7) and from 0.22 to 0.16 for walking/biking. School choice may offer academic programs that are a better fit to student preferences and needs; they are often, in short, schools to which traveling is worth it. At the same time, these trends in travel mode choice for school choice trips reveal have two concerning implications for transportation planners and education policymakers. First, transportation to choice schools imposes harms on the transportation system and the environment, with modest but significant increases in automobile use that potentially lead to added traffic congestion, VMT, and GHG emissions. Perhaps these harms could be mitigated with added district-provided transportation without sacrificing students' access to school choice programs. Second, and more importantly, these probabilities suggest that students who would rely on the school bus—which includes a disproportionate share of the poorest of California students—might be shut out of accessing choice schools, if the prevailing trend is to travel by car, to which they may have limited access (Speroni et al., 2026).

Figure 32: Average predicted probabilities of California school trip mode selection by school choice program type



There are other key results that point toward California school buses acting as a public service for those in need of mobility. Students in households without automobiles were more likely to use the school bus, even controlling for income—which previous research has shown to significantly determine automobile ownership and access (Blumenberg & Pierce, 2012; Brown, 2017). When I add a measure of walkability to the model, it is not significant—suggesting that students who walk either walk because their parents selected homes walkable to school or because they have no other choice.[57] And finally, whether a district charged transportation user fees was not significantly associated with travel mode choice, suggesting that deciding to use the school bus in California is relatively inelastic with respect to price. Suppose that the user fee variable was significant and negative, as it is in the national model. This finding would suggest that students and families are dissuaded from using the school bus when it costs money, versus when it is free to use. But in California, that the bus might cost money has no significant bearing

[57] Alternatively, it is possible that walkability measures like the National Walkability Index, which includes access to commercial activities among its components, are poor indicators of walkability to schools.

on whether or not students use it. This result suggests that in California, with its comparatively low level of school bus service, students board the yellow buses not because they want to but because they have few other choices. Further investigation into the specifics of fee policies might yield more insight into this relationship.[58]

Amid all these specific findings, the general theme remains clear: School bus use even among eligible students remains below that of the U.S. on the whole. One possible explanation for California's lower levels of school bus use is that fewer students are eligible. This chapter suggests that, even before districts can supplement what is required of them in the other 49 states, relatively fewer students in California are eligible for the school bus (42%) compared with the whole U.S. (56% of students are eligible for state-funded and/or state-required transportation). Of those who are, we might expect that the share of school bus trips among all school commutes would look similar to those of the whole nation. However, this is not the case. Only 17 percent of California students in sampled school districts take the school bus, about half the share of *all* U.S. students—eligible or not. Why the difference? While it is not clear from the data in this dissertation, I offer two potential explanations. One comes from the Theory of Repeated Behavior, which suggests that external stimuli can prompt an individual to consciously deviate from their customary behavior (Ronis et al., 1989; Wilmot & de Lapparent, 2009). California gradually wound down what was a robust school transportation system from 1982 to 2022, as state financial support did not rise with district needs (Kapphahn & Ehlers, 2014). As districts eliminated school bus service, families may have adapted by transporting their children in other ways. Another possibility is that service quality is relatively worse in California than in the rest of the U.S. This could mean longer routes with more stops, giving the school bus relatively lower utility in California than elsewhere compared with the automobile.

[58] My California School District Transportation Policy Inventory collection did include data on school district transportation fee amounts. However, the methods by which districts determine the fees that students owe vary. Some districts offer discounts for additional children in the same district; other districts provide subsidies for low-income families. Additionally, the frequency with which districts charge fees varied, from each trip to annual. It was not practical to capture all these nuances in my models, so I used a binary variable indicating whether or not a district charges fees—similar to the variable in the national models in Chapter 6.

To test this idea, I fit a linear model regressing trip duration for school bus users across the country, controlling for home-to-school distance and living in California. The results suggested that school bus trip durations in California were actually *shorter*. However, an important caveat is that this is among trips actually taken. It is still possible that the students who chose not to take the school bus did so because their trip would have been too long. Investigating this further would require district transportation route and schedule data.

8.5. Conclusion

This chapter's findings reveal the important, significant influences of institutional factors on school travel mode selection in California. Similar to the national model, eligibility for school bus service provided by the school district partly determines school trip travel mode. In addition, attending a neighborhood zone school is associated with more school bus use and more active travel, controlling for distance and bus eligibility. It should not be a surprise that policies governing the finance and provision of school bus service affect school bus use, which in California is comparatively low. Unlike in the national model, California students are not sensitive to user fees; fee or not, they will use the bus perhaps because they need to use it. Beneath of all of this, there is the potential that school buses are serving trips in California that would otherwise pose barriers to accessing education, but it may also be true that the relative dearth of school bus service is posing a barrier to educational access.

Part 4: Synthesis, Policy Implications, and Conclusion

9. Discussion

In this chapter, I discuss the implications of this research for school transportation policy and consider how policy-level changes can help improve students' transportation options and enhance their access to educational opportunities.

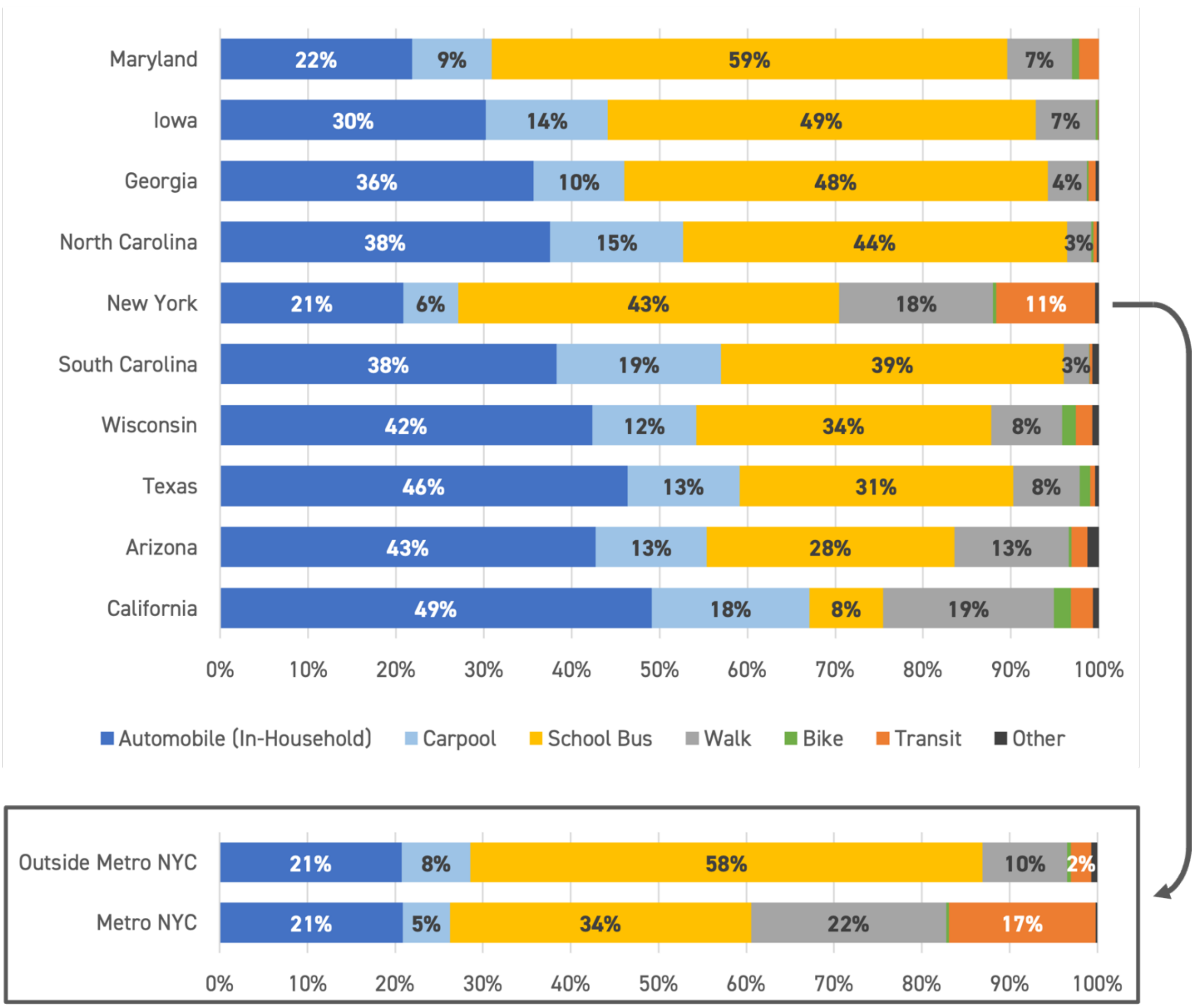
9.1. School Travel Varies Widely State to State

School travel mode choice, at least at the national level, has changed only minimally since 2001. This comes on the heels of three decades of sweeping changes, where students left walking and biking in droves in favor of traveling in their families' automobiles. But contemporary trends across states are far from analogous. The National Household Travel Survey (NHTS) data on which I rely in this dissertation include ten state over-samples that allow for single-state analyses. I aggregated these over-sampled states together and calculated the travel mode split for each state. The results—which partly motivated my research in this dissertation—revealed that the travel mode split for students traveling to/from school varied widely across the ten-state sample in 2017.

Figure 33 shows the results from this ten-state sample, sorted from the highest school bus use state to the lowest. It shows that school bus use ranged from 59 percent in Maryland to just eight percent in California. Automobile use largely functioned as the inverse of school bus use: 27 percent in New York to 67 percent in California. Even if we remove the high and low states, the differences are still stark: Iowa has nearly double (1.75 times) the school bus share of Arizona. And only part of that can be conceptually explained away by the comparatively mild weather during the school year in Arizona—while 13 percent of Arizona students walk, seven percent do so in Iowa.

Notably, these states vary across nearly all the dimensions around which I analyze school transportation policies earlier in Chapters 5 and 7: geography, fiscal capacity, political leaning, socio-demographics, and regions. The group of Arizona, California, Georgia, Iowa, Maryland, North Carolina, New York, South Carolina, Texas, and Wisconsin includes urban and rural states, wealthier and poorer states, red states and blue states, states with low and high population shares of people of color, and states from nearly every census region (there is no state from the Pacific Northwest). Someone trying to guess which states would be most generous with institutional support for transporting children to/from school and which states would be least supportive would likely struggle in that exercise. In short, this mix of state characteristics furthers the findings of Chapter 5 that there is little predictive evidence for these policies, while the descriptive statistics in Figure 33 furthers the findings that these policies—even if they are difficult to explain—have enormous influence on school travel.

Figure 33: School trip travel mode by state



Data Source: NHTS Add-On States 2017

While there are of course fluctuations between the ten states in Figure 33, there are two clear outliers: New York and California. The explanation for New York is a classic one in transportation planning. The public transit school trip mode share in New York is 11 percent, nearly four times that of the next-highest of these ten states. This is the power of New York City. I include an inset of two bar graphs at the bottom of Figure 33 that divide New York State into Metropolitan New York City and the rest of the state.[59] The rest of New York State's mode split looks a lot like Maryland—but only a third of the state's students live outside metropolitan New York City. Greater New York City carries double the weight of the rest of the state, and thus New York exhibits higher levels of walking and public transit—nearly all of it is occurring in and around the southeast corner of the state. This tracks with overall public transit use, about 45 percent of all U.S. public transit trips occur in and around New York City (American Public Transportation Association, 2025).

Determining what is happening in California requires much more nuance. The popular "pervasive myth," as Martin Wachs described it, is that Californians are addicted to cars and drive a lot (Zamichow, 1994), but when compared to the rest of the United States, this is simply not true. The average vehicle miles traveled (VMT) per capita in California was 8,728 miles per year in 2017; in the rest of the U.S. it was 9,880 miles (Davis, 2019). So, even though automobile ownership swelled in Southern California over the first 20 years of the 2000s (Manville et al., 2023), it is unlikely that Californians drive more to school and ride the school bus less simply because they are car-obsessed. Rather, the results of this research suggest that California's outlier status is a function of state policy. The systematic defunding of school transportation without any other requirement for districts to provide school bus transportation to the general student population has likely left California students and their families to sort out school travel on their own—regardless of their resources and in striking contrast to the state's reputation for robust investments in public services.

[59] The New York Core Based Statistical Area (CBSA) is comprised of the five New York City borough counties, the two Long Island Counties (Nassau and Suffolk), and five Hudson Valley counties (Dutchess, Orange, Putnam, Rockland, and Westchester).

9.2. State Policy Makes a Meaningful Difference

Findings from Chapters 6 and 8 make clear that state and local district policies about school transportation matter to how students ultimately travel to school. State requirements and financial support for districts to provide school bus transportation improve the odds of students using school buses and decrease the odds of students riding in cars, without affecting the odds of students walking or biking. These policies matter even more for middle school students, students from very poor households, students whose families have low levels of vehicle access, and for all students in the afternoon. Results vary based on built environment characteristics, but distance is a logical determinant of mode, controlling for whether a student lives in a city, suburb, or rural area. In all, these results make clear that policy is an important factor in students and families' choices in how they travel to and from school.

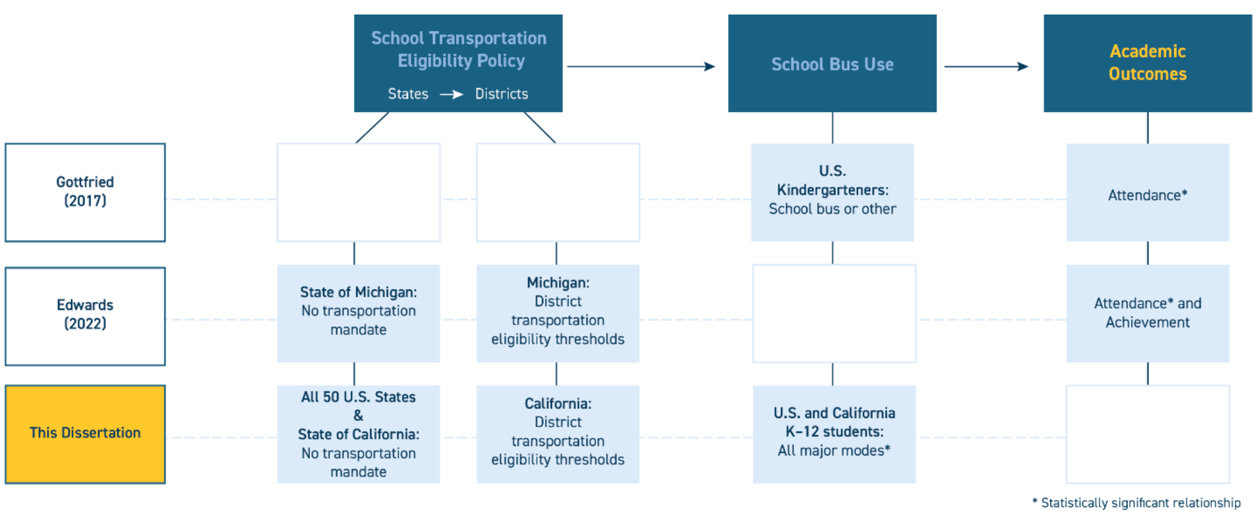
This dissertation has extended the literature by considering many of the same student, household, transportation, and school characteristics that prior studies have examined. It challenges the literature by allowing the travel mode choice set as determined by state and local school district policies to vary across students. School transportation policy—and the school bus use that it enables and facilitates—can make meaningful differences in the lives of students, families, and communities in four key ways, which I explain next.

9.2.1. Improve Educational Access and Attendance

Above all else, the chief argument for creating policy to require, support, and fund school bus service is that it enables children to physically access their education. The central role of transportation in education access began with the early days of school consolidation, which was predicated on school superintendents and boards being able to provide motorized school buses for students to access schools that were greater than walking distance from their homes (Berger, 1979; Johns, 1928). Fast-forwarding to the present day, research has continued to show an association between school bus use and improved attendance. Two of the key studies on this topic demonstrate that riding the school bus was associated with improved attendance outcomes for U.S. kindergarteners in 2011 (Gottfried, 2017) and reduced chronic absenteeism among all Michigan students in 2018 (Edwards, 2022).

The policy pathway by which school transportation shapes student outcomes is three-part. School transportation policy, set by the states and local school districts in tandem, affects school travel mode and school bus use, which in turn affect academic outcomes. Figure 34 illustrates this relationship in the context of those two key prior studies and this dissertation. In Gottfried's study, he had access to data both on whether kindergarteners used the school bus and their attendance. In Edwards', she had access to their eligibility for school bus transportation and their attendance, but not whether eligible students actually rode the bus. In this study, I have data on students' eligibilities for transportation *and* their use of the major travel modes for school trips. Undoubtedly, future research should examine these components as a trio—what explains policy, to what extent does policy affect school bus use, and how, in turn, does that use affect academic outcomes? Nevertheless, these three studies taken together suggest the validity of a three-part policy-education access-academic outcomes process. A study with all three could determine more directly the extent to which all are related.

Figure 34: Policy to outcomes process for key prior school transportation studies



9.2.2. Support School Choice

Along the same lines as above, results from the California analyses (Chapters 7 and 8) suggest that school-provided transportation may be a missing piece of school choice programs (i.e., charter schools, magnet schools, inter- and intra-district choice programs). Research on this topic has been even more limited than on school transportation overall. Proponents argue that school choice offers students and their families publicly-funded options beyond the assigned neighborhood zone school that may not be the best fit for their students (Berends, 2015). The findings from this research suggest that, at least in California, school transportation—or a lack thereof—may impede school choice for families. California school districts are significantly less likely to offer transportation to their choice program students compared to their neighborhood zone students. Further, choice students are significantly less likely to use the school bus, even when controlling for their eligibility for school bus service.

My findings that the less service is offered, the less students tend to ride school buses, taken together, suggest three things. First, without state intervention of some sort, local school district officials in charge of choice school programs are indeed less likely to view transportation as an important part of their educational duty (Hashim & Sattin-Bajaj, 2023). This view may well be shared by advocates for choice schools. Second, the findings suggest that the students and parents/caregivers who opt for choice public schools instead of their neighborhood zone schools are those who have their own transportation and are able and willing to chauffeur their children to and from school. Many choice school parents/caregivers may even prefer to drive their children to school and would do so regardless of which school their children attend, but this almost certainly does not apply to all parents. Third, it is possible that choice school students are less likely to ride school buses even when eligible to do so because the quality of bus service may be worse than what neighborhood school students receive. While districts providing school buses to traditional neighborhood zone schools can rely on economies of scale transporting children from only a few neighborhoods to a single school, providing choice school transportation requires picking up students in many more neighborhoods and dropping them off at many schools—a far more complex operation (Burgoyne-Allen & O'Neal Schiess, 2017).

The findings here, along with prior research (Edwards, 2021; Speroni et al., 2026; Valant & Lincove, 2023), suggest that students are less likely to attend public choice schools if their families do not have automobile access. Consequently, in California, students without either a school bus or a family vehicle are especially unlikely to have access to these choice educational opportunities—not because they are ineligible for them or they are a poor fit for the program, but because they have no viable way of getting to the choice school unless they are lucky enough to live within walking distance—which model results suggest is unlikely. This result is especially concerning for students assigned to poor-performing neighborhood schools who may benefit most from attending choice schools.

9.2.3. Reduce Family Transportation Burdens

Escorting children to school—whether on foot or bike or chauffeuring in a car—increases the demand on parents'/caregivers' time. Providing school bus transportation increases the suite of options available to families in transporting children to school. School trips, like most adult work commutes, are non-discretionary travel with rigid schedules. Without school-provided transportation, parents who live beyond walking distance of their child's school (or who have children too young to walk unsupervised) may have to balance the competing needs of multiple children attending multiple schools, as well as their own need to travel to work. Providing school bus service is a way to lessen this burden by increasing travel choices and freeing up parents'/caregivers' time. This is especially important for families without sufficient or reliable automobile access, and where satisfying these travel demands on general public transit service is untenable (Kent, 2022). School buses also offer greater levels of safety and supervision as compared with public transit or even walking or biking, which can help to assuage parents fears of "stranger danger" (McDonald & Aalborg, 2009).

9.2.4. Reduce Congestion and Environmental Externalities

Finally, when students ride school buses instead of being chauffeured in private cars the transportation system benefits through fewer cars on the road and fewer vehicle miles traveled (VMT). Fewer cars on the road reduces traffic congestion, particularly around schools, reducing travel durations for students and families (Cooner, 2009) and ameliorating some of the safety risks associated with parent drop-off lines (Rothman et al., 2016, 2017). Fewer VMT—particularly VMT in congestion—reduces greenhouse gas emissions and harmful particulate matter in the air (Simeonova et al., 2019). Although older diesel school buses are often significant emitters of particulate matter, shifts to cleaner diesel buses, natural gas buses, and battery-electric school buses significantly increase the environmental benefits of school buses (Bursey & Kalisa, 2025).

But VMT reductions are not good in and of themselves. There are trade-offs. For example, the extra four vehicle miles per day that a family's trips to and from a public choice school entail might not come even close to the benefits that the student gains from attending a specialized educational program. And, at least in California, that student probabilistically does not have access to a school bus for that trip even if they wanted one. My point is not to recommend policies that force families out of their cars or to restrict school choice. Rather, my point is that state and local school district officials can create school transportation policies that nudge students and families toward using shared (e.g., school bus, carpooling, and public transit) and active (e.g., walking and biking) travel modes when it makes sense. Part of that nudge means that school transportation must be provided when walking is impractical.

9.3. Policy Implications

Based on these findings and observations, I discuss below four major policy implications of my research, as well as recommendations for future school transportation policy reform and innovation.

9.3.1. Reasonable Walking Distance Expectations and Equitable Policies

Beyond the overall effects of state and local policy on student travel, the most striking takeaway from the analyses in this dissertation is the mismatch between state and local school transportation eligibility criteria and the trips for which students *actually* walk to/from school. Across the country, institutional officials' expectations for how far students can or should walk drastically outstrip my predictions for whether students *will* walk. As Chapters 5 and 7 show, state and district policies typically set thresholds beyond which students must live in order to receive school bus service. Given that most students are not of age to drive (or do not have the independent financial means to drive if they are of age), the implicit expectation here is that students inside that threshold can walk.

Table 23 summarizes transportation eligibility thresholds. Over half of all states and California districts expect their students to walk two or more miles to and from school. Up to a quarter of districts expect three or more miles. On average, states require districts to provide transportation beginning at 1.9 miles and fund it beginning at 1.3 miles. California districts begin providing transportation, again on average, at 1.9 miles for zone school students and two miles for choice school students.

Table 23: School Transportation Eligibility Thresholds and Predicted Rates of Walking

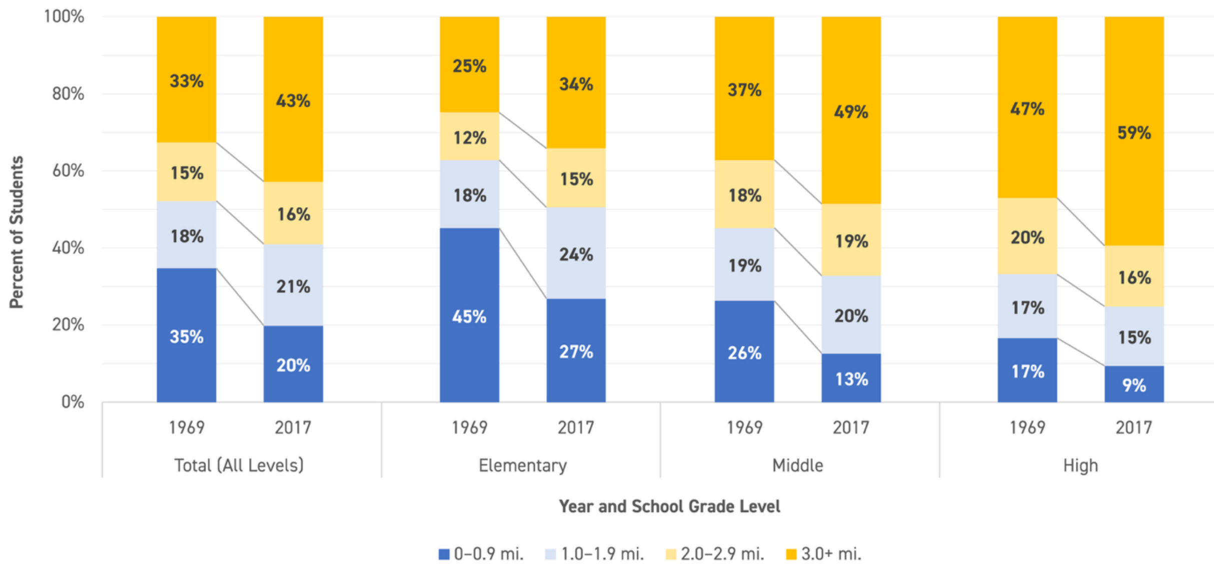
Policy Type	*U.S. States*		*California Districts*	
	Mandate	Funding	Zone School	Choice School
% Greater than 2 mi.	64%	42%	52%	50%
% Greater than 3 mi.	16%	11%	15%	25%
Avg. Eligibility Threshold (mi.)	1.87	1.30	1.90	2.02
Predicted Probability at Avg.	0.05	0.12	0.09	0.07

But are these expectations reasonable? I calculated the predicted probabilities of students walking at the average distance thresholds for each of these categories, and the results overwhelmingly suggest that these numbers are not even *close* to reasonable. Again, controlling for whether students were eligible for school bus service, the model from Chapter 6 predicts that only *five* percent of students would walk at the average threshold at which states require districts to provide transportation. Do local districts recognize a difference? Evidence from California suggests that they do not recognize much of one. The California model (Chapter 8) predicts only nine percent of students to walk at a 1.9-mile transportation eligibility threshold. These numbers suggest that states and districts generally do not determine walkability based on actual walking but rather based on other factors.

I suspect there are two converging reasons for the lack of connection between actual walking and the walking expected by policy. First, as I acknowledge throughout this dissertation, public resources are limited. State and district policymakers may make calculated decisions about how much transportation they can actually afford, and one way of constraining costs is by increasing the eligibility distance. While students may be extraordinarily unlikely to walk two miles to school, it is not technically impossible. Children living five or more miles away from school nationally have a less than one percent predicted probability of walking to school—and even that is probably statistically generous. Second, many of these state and local school transportation policies are decades (if not a century) old (California Department of Education, 2021; Johns, 1928), and walking expectations may have become outdated.

Students' home-to-school distances have changed over time, and it is far more common for students to live beyond these average distance thresholds now than it was 50 years ago. Figure 35 shows categorical home-to-school distances for U.S. students in 1969 and 2017. Across all school levels, the shares of students living within a mile of their schools shrunk between 1969 and 2017, while the shares of students living two or more miles from school expanded. In 1969, over a third of all students lived within a mile of school. That figure had dropped to just 20 percent by 2017. Thus, while policymakers' expectations for students living beyond a given walking distance from school may have been rooted in reality in the middle of the 20th century, today the landscape beneath these policies has (metaphorically and literally) shifted.

Figure 35: Changes in home-to-school distance 1969–2017



Data Source: NPTS 1969, NHTS 2017

More of today's students live farther from school, and more of today's schools have sprawled (Schlossberg et al., 2005) to sites that are less likely to be walkable and transit-accessible (Vincent et al., 2022). Amid these changes, the expectations that school transportation policies put forth have become disconnected from current conditions. As state and district officials evaluate their school transportation policies, they should be careful not to set expectations for children to walk longer distances than we can reasonably expect of them. Of course, distance cut-offs are subject to local context—Manhattan, Kansas faces different challenges from Manhattan, New York—but institutions should not design school transportation policies expecting children to walk distances at which the data suggest walking is improbable. In those instances, only children and families left with no other option would resort to walking. Setting policies for school transportation eligibility at realistic home-to-school walking distances—where travel data suggest walking is still somewhat probable—would create a more equitable transportation system in which all students have efficient access to school.

9.3.2. Planning for Afternoons

Both across the U.S. and in California, students were more likely to ride in a car on the way to school and rely on another mode on the way home. However, most state school transportation policies and California school district transportation programs in the data I collected appear to have been designed on the proverbial assumption that what goes up must come down—that children who travel one way to school in the morning travel the same way on the way home. While it is true that every day nearly every student returns home eventually, one way or another (save for sleepovers at friends' or relatives' homes), state and district officials should acknowledge that the morning and afternoon mode splits among students differ notably. Parents/caregivers who are available to chauffeur students in the morning are apparently not, on average, as available in the afternoons. Accordingly, officials at both the state and local levels should plan for afternoon school bus capacity and walking patterns, so that the students who arrived at school can also safely and efficiently get home.

9.3.3. A Case for Fee-Free School Transportation

In my national analysis, there is a relationship between states authorizing districts to charge fees for school bus use and student travel mode. With fees, driving goes up and school bus use goes down. On the one hand, districts could choose to implement these fees only for students with the means to pay, thereby ameliorating some potential equity issues. This is California's state policy as of 2023 (Ekbatani, 2022). On the other hand, just *authorizing* these fees has an almost inverse effect on school bus use compared with the effect of state and local district support. The benefits school bus service offers only accrue to students, families, and communities when students actually use the bus. Fee-free transportation removes an obstacle to using school buses for all students in using school buses More student use increases the overall efficiency of the system through economies of scale (Ellegood et al., 2020). Perhaps just as importantly, maintaining free-of-charge access to school buses might help parents and students to not see the bus as the mode of last resort.

Of course, districts need ways to pay for school transportation, and fees can be an important source of revenue. However, I have two concerns about this. First, it presents an equity dilemma: some students live in households that cannot afford cars or have parents/caregivers who cannot chauffeur them to school in cars. Second, the revenue districts generate from fees is unlikely to recoup anything close to the full costs from public sources of providing school transportation. For many years, an axiom in public finance was that we do not feed all children free-of-charge lunch just because some children are hungry. But the tide may be turning on that issue; districts and states across the country—including California—have enacted universal free lunch (and sometimes breakfast) (Thompson & Coakley, 2026).[60] Justification for universal free lunch programs has centered on reducing stigma, eliminating lunch debt (unpaid balance for school lunch owed), promoting equitable access to nutrition, and recognizing that schools should provide meals to children during the school day regardless of income (Gagliano et al., 2023). In other words, no child should suffer the embarrassment of being unable to pay for a meal, and every child should be fed at a place they are legally required to be. On similar grounds, state and local school district officials would benefit both children and the transportation system by enacting similar free-of-charge policies for school bus service.[61] It may even lead to cost savings in the reduced administrative burden from not collecting fees. Schools with universal free meals have lower per-meal costs than those that collect lunch fees (M. W. Long et al., 2021).

9.3.4. Making School Choice a Real Choice

Earlier in this chapter, I discussed California students' lower likelihood of school bus use and walking, compared to driving, for school trips taken by students attending choice public schools. The

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[60] As of early 2026, nine states have universal free school lunch: California, Colorado, Maine, Massachusetts, Michigan, Minnesota, New Mexico, New York, and Vermont (Thompson & Coakley, 2026).

[61] Eliminating school bus fee revenue would be a financial imposition on many school districts that currently collect fees. States should step in and use their broader revenue bases to help districts weather this shortfall. Ultimately, if districts wanted to raise revenue from transportation, it would be economically better to charge parents/caregivers for dropping off and picking up students in their cars instead of charging students for using the school bus. This approach would do a better job of internalizing some of the externalities that parents chauffeuring children to school causes, including traffic congestion, vehicle emissions, and added safety risks. However, I suspect this policy would be extraordinarily politically unpopular.

policy reality of these trends is that choice schools are likely underserving students who are mobility-constrained. To address this, states should tie district expansions of school choice programs to corresponding expansions in transportation programs that serve these schools and students. To offer these choice school programs without offering a means of transportation to and from school is not a real offering—it is an offering *conditioned* on the ability (owning a car) and willingness (having the time) of parents/caregivers to transport their children.

There is, however, nuance to this recommendation. This research suggests that school choice programs are under-resourced in school transportation. State officials should increase resources and direct districts to provide transportation that facilitates school choice participation. In fact, my results in Chapter 7 suggest that more state funding for school transportation generally is associated with higher likelihood of district school choice transportation offerings—even where the state set transportation funding amounts (in 1982) before charter schools even existed (1991). At the same time, public resources are scarce and both state and local officials face trade-offs when deciding to spend limited public money on school transportation. Expanding school choice transportation cannot come at the expense of reducing transportation to neighborhood zone schools. That would be a prime example of proverbially robbing Peter to pay Paul. I am not advocating for districts to reduce zone school transportation in order to operate school choice programs; I am suggesting that states should compel districts to only offer school choice programs *if* those programs include viable, practical transportation options.

9.4. Directions for Future Research

There are many school access/transportation research gaps that deserve attention. I emphasize seven of them here. First, while my California analysis sheds light on what local school districts do when the state gives them more program autonomy and financial responsibility in providing school transportation, California's relative lack of policy in this regard means that it was not possible to understand several aspects of how state policy could affect local policy. It would be further instructive to analyze states with more explicit and generous state school transportation policies that can also be connected to student travel behavior.

Second, regarding California's school transportation policies, future research should examine the effects of the state's new funding formula on program implementation and student school travel. As I mentioned earlier, the state refashioned its school transportation formula to reimburse districts for up to 60 percent of transportation costs as of 2023 (Ekbatani, 2022). Future research should track the implementation of these new funds and analyze the extent to which districts expand school bus service transportation as a result of them. Additionally, future studies should consider whether 60 percent is enough to nudge districts into expanding their transportation offerings, rather than just shoring up the funding of their existing operations. Although the results of Chapter 6 suggest that there is not a meaningful difference between states requiring districts to provide transportation and states funding transportation, many—if not most—of those policies are old and date to the school consolidation movement, when states were funding transportation as district school bus systems expanded. It is not yet clear whether funding alone will nudge district-level expansion of transportation systems in a state where the school bus system gradually shrank from 1982 to 2022 (Kapphahn & Ehlers, 2014). Forty percent of costs, even accounting for the 60 percent reimbursement for existing service, is still a lot of money for districts.

Third, this dissertation focuses on whether states have school transportation funding formulas and/or authorize districts to charge transportation user fees. Further research should investigate *how much* funding states provide to districts and if there is some optimal amount or mechanism of doing so. While the model in Chapter 6 suggests that requiring districts to provide transportation or state funding of it are not meaningfully different, it is possible that modeling funding as a "yes" / "no" binary obscures variation in school travel outcomes related to the amount of funding states send to districts. Along similar lines, there is much more for researchers to explore about the amounts school districts charge to families in transportation user fees. It is possible that the negative association between state fee authorization and school bus use is driven by the dollar amount districts are charging rather than by whether districts are charging any amount at all.

Fourth, while my research suggests that school choice students are less likely than neighborhood zone students to use transportation when it is offered, the key next step is to understand *why* this happens. For example, one possible explanation is that school bus service quality is worse for choice school students, with longer routes and more destinations leading to more complicated trips. Future studies can explore how to optimize the many origins (neighborhoods) and many destinations (schools) problem that districts face in operating transportation systems for choice schools—especially when it seems public transit is not well-suited for this task (Gross & Denice, 2017).

To that end, fifth, many scholars have examined the role of public transit as school transportation, myself included (Burdick-Will & Stein, 2025; Dustan & Ngo, 2018; Ermagun & Levinson, 2017; Palm & Farber, 2020; Speroni et al., 2025; Wexler et al., 2021). But all of these studies primarily focus on public transit as a substitute for school buses. Even in Greater New York City—which again is the dominant capital of U.S. public transit—school bus mode share is *double* that of public transit (subway, commuter rail, and buses) on school trips. In other words, school bus mode share is high even in one of the few places in North America where public transit may have a comparative speed and efficiency advantage over driving. Scholars should continue to examine how public transit can serve student school trips, but I suggest that these inquiries focus instead on trips that are not economies-of-scale trips. Rather than studying how public transit can serve the masses of students who leave school right at afternoon dismissal times, we should instead investigate how public transit can better facilitate more exceptional trips, like students traveling home two hours after dismissal from tutoring, theater rehearsals, band practices, or sports practices.

Practically (and sixth), travel behavior research relies on quality travel behavior data. Travel surveys, like the Federal Highway Administration's National Household Travel Survey (NHTS) program that conducted the surveys that ultimately led to the data I use in this research, remain critical sources for transportation research. However, federal, state, and regional governments have begun to de-emphasize traditional travel surveys in favor of big data approaches to transportation analysis, such as location-based services (LBS) and large administrative datasets. While there is certainly value in these newer, larger datasets, they often remove the human connection—and while doing so in the name of privacy is good and important, it removes the ability for researchers to draw important conclusions about travel and travelers. For example, LBS data do not allow researchers to identify whether trips are taken by children. Not only are larger-sample NHTS data collections important, but so too are state add-ons that allow researchers to understand how state policy can shape travel in that state. Travel surveys remain a vital piece of the whole picture in transportation studies, and I implore transportation officials to continue investing in them.

Finally, as I mentioned earlier in this chapter, future research is needed to connect school transportation policy and student travel with what matters most: student academic outcomes. This is the holy grail of scholarship on school access, and the almost total absence of work on this topic speaks to the deep gap between education and transportation scholarship.

10. Conclusion

When the 55 million U.S. K-12 students make their journeys to and from school each school day, their travel enables educational opportunities and affects the functioning of transportation systems, families, and communities. In this dissertation I have shown that those journeys are not determined solely by household preferences and neighborhood characteristics, and that we should not assume that students all have similar sets of transportation choices. School access is also influenced by institutional decisions that policymakers make at the state and school district levels about who receives school bus transportation, how that transportation is funded, and whether families are expected to pay fees to use it. By documenting the substantial variation in those school transportation policies and by demonstrating their associations with student travel behavior, I argue that school transportation opportunity is not simply a matter of geography or household preference—it is itself an institutional outcome.

School transportation has long been a split domain, existing somewhere between transportation planning and education policy and receiving relatively little attention from either field—despite its importance to both. As states and school districts confront changing student needs, fiscal pressures, evolving adult travel behavior, and new education models, transportation should remain central to ensuring that students can access the schools available to them. This dissertation has challenged the prior scholarship by considering school transportation policies and the options they determine for families as important variables rather than fixed assumptions. Understanding the relationship between school transportation policies and student behavior is not only an academic question but a practical one for planners, educators, and policymakers who seek to build efficient and equitable systems in both transportation and education.

Appendices

A. State Policy Data Citations

Table A-1 presents the citations from state statutes, administrative codes, and other bureaucratic sources that establish state school transportation policies. These citations correspond to the analyses in Chapter 5 of the dissertation.

Table A-1: State school transportation policy citations by policy component

State	Requirements	Funding Formula	Eligibility	Fee Authorization	Reimbursements
AL	AL ST § 16-27-1; AL ST § 16-8-13	AL ST § 16-13-233; AL ST § 16-39-11	AL ST § 16-13-233	—	—
AK	AK ST § 14.09.010; AK ST § 14.09.020	AK ST § 14.09.010	AK ST § 14.09.010	—	4 AK ADC 27.032
AZ	Ariz. Rev. Stat. §15-342(12)	Ariz. Rev. Stat. §15-922, 15-945	Ariz. Rev. Stat. §15-342(12)	—	—
AR	AR ST § 6-19-101; AR ST § 6-19-102	AR ST § 6-20-2309; AR ST § 6-20-604		—	—
CA	Cal. Educ. Code § 39800	—	Cal. Educ. Code § 39800	Cal. Educ. Code § 39807.5	—
CO	CO ST § 22-32-113	1 CO ADC 301-14	1 CO ADC 301-14	Colorado Dept. of Education	Colorado Dept. of Education
CT	CT ST § 10-186; CT ST § 10-220c	CT May Special Session, Public Act No. 16-2	CT ST § 10-186; CT ST § 10-220c	—	—
DE	Delaware Dept. of Education website	Del. Admin. Code § 14.1100.1150.17	Delaware Dept. of Education website	Del. Admin. Code § 14.1100.1150	—
FL	FL ST § 1006.21	FL ST § 1011.68	6 FL ADC 6A-3.001	—	—
GA	GA Code § 20-2-188; GA Public Policy Foundation Report	GA Code § 20-2-188; GA DFB §160-5-3.11	GA Code § 20-2-188; GA Public Policy Foundation Report	—	—
HI	HI ST § 302A-406	HI ST § 302A-407	—	HI ST § 302A-407	—
ID	ID ST § 33-1501	ID ST § 33-1006; ID ST § 33-1513	ID ST § 33-1501	—	ID ST § 33-1503
IL	IL ST CH 105 § 5/29-3	IL ST CH 105 § 5/29-5	IL ST CH 105 § 5/29-3	IL ST CH 105 § 5/29-2	—
IN	IC 20-27-5-2	—	IC 20-27-5-2	IC 20-27-5-2	—
IA	Iowa Code §285.1	Iowa Code §285.1	Iowa Code §285.1	Iowa Code §285.1	Iowa Code §285.1
KS	KS ST 72-6487	KS ST 72-5148	KS ST 72-6487	KS ST 72-6487	KS ST 72-6489
KY	KY ST § 158.110	KY ST § 157.370	KY ST § 158.110	—	—
LA	LA R.S. 17:158	—	LA R.S. 17:158	LA R.S. 17:158	LA R.S. 17:158

State	Requirements	Funding Formula	Eligibility	Fee Authorization	Reimbursements
ME	ME ST T. 20-A § 5401	ME ST T. 20-A § 5401	ME ST T. 20-A § 5401	—	—
MD	MD Code Reg. §13A.06.07	Maryland Educ. Code §5-205	MD Code Reg. §13A.06.07	Maryland Educ. Code §7-801	—
MA	MA ST 71 § 68; MA ST 71 § 16C	MA ST 71 § 7A	MA ST 71 § 68	MA ST 71 § 68	—
MI	MI ST 380.1321 (1)	MI ST 388.1622l	MI 380.1321 (3)	MI ST 380.1321 (2)	—
MN	MN ST § 123B.88	MN ST § 126C.10 (18)	MN ST § 123B.88	MN ST § 123B.36 (11)	—
MS	MS ST § 37-41-3	MS ST § 37-151-85	MS ST § 37-41-3	—	—
MO	MO ST 167.231	MO ST 163.161	MO ST 167.231	MO ST 167.231	—
MT	MT ST 20-10-121	MT ST 20-10-141; MT ADC 10.7.112	MT ST 20-10-121	—	—
NE	NE ST § 79-611; NE ST § 79-601	NE ST § 79-1007.12	NE ST § 79-611	NE ST § 79-241	NE ST § 79-611 (3)
NV	NV ST 386.790	NV ST 387.1214; SPED: NV ST 387.12445	NV ST 386.790	NV ST 386.800	NV ST 386.810
NH	NH ST § 189:6	—	NH ST § 189:6	—	—
NJ	NJ ST 18A:39-1	NJ ST 18A:7F-57		NJ ST 18A:39-1.3	—
NM	NM Stat § 22-16-4	N. M. S. A. 1978, § 22-8-26, 29	NM Stat § 22-16-4	—	—
NY	NY. Educ. Law §3635	NY. Educ. Law §3602, 3620	NY. Educ. Law §3635	—	—
NC	N.C. Code ¢115C-239 - 115C-262	N.C. Code ¢115C-239 - 115C-262	N.C. Code ¢115C-239 - 115C-262	—	—
ND	ND ST 15.1-30-01	ND ST 15.1-27-26.1; ND ST 15.1-27-27.1; ND ST 15.1-27-31.1	ND ST 15.1-27-26.1	ND ST 15.1-30-02	ND ST 15.1-30-05
OH	OH ST § 3327.01; OH ST § 3327.01	OH ST § 3317.0212; OH ST § 3317.0214	OH ST § 3327.01	OH ADC 3301-83-24; OH ST § 3327.07	OH ST § 3327.01
OK	OK ST T. 70 § 9-101	OK ST T. 70 § 18-200.1; OK ST T. 70 § 9-110; OK ST T. 70 § 9-111	OK ST T. 70 § 9-101	OK ST T. 70 § 9-108	—
OR	OR ST § 327.043	OR ST § 327.013 3(a); OR ST § 327.006 2(a); OR ADC 581-023-0040	OR ST § 327.043	—	—
PA	PA ST 24 P.S. § 13-1361	PA ST 24 P.S. § 25-2541; PA ST 24 P.S. § 13-1361	PA ST 24 P.S. § 13-1366	PA ST 24 P.S. § 13-1361	School District of Philadelphia
RI	RI ST § 16-21-1	—	RI ST § 16-21-1	—	—
SC	SC Code § 59-67-410 (2020)	SC Code § 59-67-420 (2020)	SC Code § 59-67-410 (2020)	—	—
SD	SD ST § 13-29-1; SD ST § 13-29-19	—	SD ST § 13-29-1; SD ST § 13-29-19	SD ST § 13-29-19	SD ST § 13-29-19

State	Requirements	Funding Formula	Eligibility	Fee Authorization	Reimbursements
TN	TN ST § 49-6-2101	BEP Blue Book (NOT statutory; directive in TN ST § 49-3-355)	TN ST § 49-6-2101	TN ST § 49-6-2103	TN ST § 49-6-2104
TX	—	Tex. Educ. Code §34.007, §48.151; TEA Handbook	Tex. Educ. Code §34.007, §48.151; TEA Handbook	Tex. Educ. Code §34.007	Tex. Educ. Code §48.151
UT	UT ST § 53E-3-501	UT ST § 53F-2-402; UT ST § 53F-2-403; UT ADC R277-600-5; UT ADC R277-600-12	UT ST § 53F-2-403; UT ADC R277-600-4	UT ST § 53G-7-503	UT ADC R277-600-6
VT	VT ST T. 16 § 1222	VT ST T. 16 § 4016	VT ST T. 16 § 1222; VT ST T. 16 § 4016	—	VT ST T. 16 § 1222
VA	VA ST § 22.1-176	VA ST § 22.1-115; VA ST § 22.1-221	VA ST § 22.1-115; VA ST § 22.1-221	VA ST § 22.1-176	—
WA	WA ST 28A.160.010	WA ST 28A.160.180; WA ST 28A.160.130; WA ST 28A.160.192	WA ST 28A.160.010	—	WA ST 28A.160.030
WV	WV ST § 18-2E-5	WV ST § 18-9A-7	WV ST § 18-5-13; WV ADC § 126-92-3	—	WV ST § 18-9A-7
WI	Wis. Stat. Ann. §121.54	Wis. Stat. Ann. §121.58	Wis. Stat. Ann. §121.54	Wis. Stat. Ann. §121.54-8	—
WY	WY ST § 21-3-131; WY ST § 31-5-118	WY ST § 21-13-320	WY ST § 21-13-320	—	WY ST § 1-4-401

— = Policy not applicable to state

B. California Student Travel Mode Alternate Models

In Chapter 8, I mentioned two alternative models of California school travel mode choice. The first alternative model predicts travel mode selection based on a larger suite of independent variables from the NHTS but in doing so excludes both the school choice and district transportation policy variables. The second alternative model includes the same predictors as the main model in Chapter 8 (Table 21), but without the district transportation policies. By excluding these variables, I am able to increase the sample size relative to the primary model. Alternative Model 1 is the largest sample (5,111 trips), while Alternative Model 2 is slightly smaller (4,368 trips) because not all students from the NHTS matched to schools. Neither of these models are constrained by the 119-district sample of school district transportation policies. Table B-1 contains the descriptive statistics for both alternative models. Table B-2 contains the results of Alternative Model 1, and Table B-3 contains the results of Alternative Model 2.

Table B-1: Descriptive statistics of alternate models

	Alternate Model 1 *(No Choice, No Transport Policy)*		**Alternate Model 2** *(Choice, No Transport Policy)*	
Variable	**Unweighted Freq.**	**Unweighted Pct.**	**Unweighted Freq.**	**Unweighted Pct.**
Outcome: Mode Choice				
Automobile	3,360	65.7%	3,139	71.9%
School Bus	509	9.9%	426	9.8%
Walk/Bike	942	18.4%	803	18.4%
Total	5,111		4,368	
Student				
School level (Age)				
Elementary	2,610	51.1%	2,200	50.4%
Middle	1,125	22.0%	953	21.8%
High	1,376	26.9%	1,215	27.8%
Student gender				
Male	2,571	50.3%	—	—
Female	2,540	49.7%	—	—
Student disability				
No	4,994	97.7%	4,280	98.0%
Yes	117	2.3%	88	2.0%
Driver (any age)				
No	4,792	93.8%	4,084	93.5%
Yes	319	6.2%	284	6.5%

Variable	Alternate Model 1 (No Choice, No Transport Policy)		Alternate Model 2 (Choice, No Transport Policy)	
	Unweighted Freq.	Unweighted Pct.	Unweighted Freq.	Unweighted Pct.
Race/ethnicity				
Asian	526	10.3%	461	10.3%
Black	204	4.0%	160	4.8%
Latino/a	1,257	24.6%	1,096	26.6%
White	2,520	49.3%	2,153	46.8%
Other	604	11.8%	498	11.5%
Caregiver / Household				
Household structure				
Single-parent	759	14.9%	—	—
2+ parents	4,352	85.2%	—	—
Household income				
< $25,000	602	11.8%	519	11.9%
$25,000 – $49,999	670	13.1%	575	13.2%
$50,000 – $74,999	661	12.9%	567	13.0%
$75,000 – $99,999	612	12.0%	537	12.3%
$100,000 – $149,999	1,218	23.8%	1,010	23.1%
$150,000 – $199,999	568	11.1%	502	11.5%
≥ $200,000	780	15.3%	658	15.1%
Homeownership				
No	1,646	32.2%	—	—
Yes	3,465	67.8%	—	—
Chose home: Convenient to school				
No	3,993	78.1%	3,403	63.7%
Yes	1,118	21.9%	965	36.3%
Chose home: School system				
No	3,361	65.8%	2,882	66.0%
Yes	1,750	34.2%	1,486	34.0%
Parent with college degree (1+)				
No	1,838	36.0%	1,581	36.2%
Yes	3,273	64.0%	2,787	63.8%
Trip / Transportation				
Distance home-to-school (miles)				
<0.5 mi.	471	9.2%	400	9.2%
0.5–0.99 mi.	896	17.5%	738	16.9%
1.0–1.49 mi.	673	13.2%	601	13.8%
1.5–1.99 mi.	487	9.5%	421	9.6%
2.0–2.99 mi.	752	14.7%	642	14.7%
3.0–4.99 mi.	699	13.7%	617	14.1%
≥5 mi.	1,133	22.2%	949	21.7%
Trip time				
AM	2,649	51.8%	2,261	51.8%
PM	2,462	48.2%	2,107	48.2%
Trip season				
Fall	2,231	43.7%	1,890	43.3%
Winter	1,412	27.6%	1,221	28.0%
Spring	1,468	28.7%	1,257	28.8%
Household vehicle status				
Zero vehicles	41	0.8%	32	0.7%
Vehicle deficit	508	9.9%	421	9.6%

	Alternate Model 1 (No Choice, No Transport Policy)		Alternate Model 2 (Choice, No Transport Policy)	
Variable	**Unweighted Freq.**	**Unweighted Pct.**	**Unweighted Freq.**	**Unweighted Pct.**
Vehicle+ per driver	4,562	89.6%	3,915	89.6%
School Characteristics				
School program type				
Neighborhood zone	—	—	2,469	56.5%
Public choice	—	—	1,478	33.8%
Private choice	—	—	421	9.6%
District Policies				
District school bus eligibility				
Not eligible	—	—	—	—
Eligible	—	—	—	—
District transport user fee				
No fee	—	—	—	—
Fee	—	—	—	—
Built Environment				
California metro area				
Not in major metro	1,882	36.8%	1,577	36.1%
San Joaquin Valley	289	5.7%	266	6.1%
Greater Los Angeles	839	16.4%	741	17.0%
Sacramento	884	17.3%	736	16.9%
San Diego	525	10.3%	481	11.0%
San Francisco Bay Area	692	13.5%	567	13.0%
Neighborhood type (Urbanicity)				
Urban	261	5.1%	187	11.0%
Suburban	4,267	83.5%	3,699	84.7%
Rural or Small Town	583	11.4%	482	11.0%

Omitted from model for parsimony: Gender, Siblings, Household structure, Homeownership, Foreign-born parent (1+), Parent medical condition (1+), Parent flexible schedule (1+), Travel day of week, Walkability, High-quality transit access, School demographics, School achievement levels, State HTST Fund allocations per pupil

Table B-2: Model results (includes only NHTS data; no school choice; no district transportation policy)

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
Student								
School level (Age)	0.000	***						
Elementary			Ref			Ref		
Middle			0.491	**	0.002	1.012	***	0.000
High			0.209		0.237	1.713	***	0.000
Student gender	0.003	**						
Male			Ref			Ref		
Female			-0.211		0.129	-0.353	**	0.001
Student disability	0.000	***						
No			Ref			Ref		
Yes			1.300	***	0.000	-1.183	*	0.025
Driver (any age)	0.000	***						
No			Ref			Ref		
Yes			-1.409	**	0.007	-1.705	***	0.000
Race/ethnicity	0.012	*						
Asian			-0.561		0.066	-0.331		0.091
Black			0.597		0.080	0.404		0.127
Latino/a			-0.103		0.548	0.269		0.055
White			Ref			Ref		
Other			-0.347		0.153	-0.111		0.543
Caregiver / Household								
Household structure	0.001	***						
Single-parent			-0.801	***	0.000	-0.276		0.094
2+ parents			Ref			Ref		
Household income	0.000	***						
< $25,000			1.511	***	0.000	-0.150		0.522
$25,000 – $49,999			0.993	***	0.000	-0.304		0.163
$50,000 – $74,999			0.827	**	0.001	-0.438	*	0.033
$75,000 – $99,999			0.189		0.513	-0.316		0.106
$100,000 – $149,999			Ref			Ref		
$150,000 – $199,999			0.084		0.782	-0.529	**	0.006
≥ $200,000			0.620	*	0.019	-0.192		0.329
Homeownership	0.009	**						
No			Ref			Ref		
Yes			-0.087		0.618	-0.419	**	0.002
Chose home: Convenient to school	0.000	***						
No			Ref			Ref		
Yes			0.281		0.150	0.559	***	0.000
Chose home: School system	0.000	***						
No			Ref			Ref		
Yes			0.662	***	0.000	0.208		0.091
Parent with college degree (1+)	0.008	**						
No			Ref			Ref		
Yes			-0.515	**	0.003	0.062		0.668
Trip / Transportation								
Distance home-to-school (miles)	0.000	***						
<0.5 mi.			Ref			Ref		
0.5–0.99 mi.			0.556		0.296	-1.338	***	0.000

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
1.0–1.49 mi.			0.611		0.263	-2.208	***	0.000
1.5–1.99 mi.			1.117	*	0.040	-3.374	***	0.000
2.0–2.99 mi.			1.305	*	0.013	-3.609	***	0.000
3.0–4.99 mi.			1.430	**	0.006	-4.010	***	0.000
≥5 mi.			1.578	**	0.002	-4.481	***	0.000
Trip time	0.000	***						
AM			Ref			Ref		
PM			0.308	***	0.000	0.479	***	0.000
Trip season	0.048	*						
Fall			Ref			Ref		
Winter			0.237		0.145	-0.212		0.112
Spring			-0.081		0.636	0.114		0.383
Household vehicle status	0.036	*						
Zero vehicles			1.396	*	0.033	1.568	**	0.003
Vehicle deficit			0.124		0.602	0.179		0.346
Vehicle+ per driver			Ref			Ref		
Built Environment								
California metro area	0.000	***						
Not in major metro			Ref			Ref		
Greater Los Angeles			-1.062	***	0.000	-0.416	*	0.018
Sacramento			-0.683	**	0.001	0.192		0.245
San Diego			-1.209	***	0.000	0.197		0.342
San Francisco Bay Area			-1.055	**	0.001	0.040		0.830
San Joaquin Valley			0.225		0.318	-0.198		0.400
Neighborhood type (Urbanicity)	0.000	***						
Urban			0.626		0.117	0.780	**	0.001
Suburban			Ref			Ref		
Rural or Small town			1.060	***	0.000	-0.087		0.773
Constant			-3.672	***	0.000	0.516		0.062

n = 5,111 * P < 0.05 ** P < 0.01 *** P < 0.001

Standard errors clustered by individual to account for AM and PM trips for each student.

Omitted from model for parsimony: Gender, Siblings, Household structure, Homeownership, Foreign-born parent (1+), Parent medical condition (1+), Parent flexible schedule (1+), Travel day of week, Walkability, High-quality transit access, School demographics, School achievement levels, State HTST Fund allocations per pupil

Table B-3: Model results (includes school choice; no district transportation policy)

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
Student								
School level (Age)	0.000	***						
Elementary			Ref			Ref		
Middle			0.213		0.257	1.146	***	0.000
High			-0.282		0.165	1.607	***	0.000
Student disability	0.000	***						
No			Ref			Ref		
Yes			1.528	***	0.000	-1.452	*	0.013
Driver (any age)	0.000	***						
No			Ref			Ref		
Yes			-1.187	*	0.017	-1.866	**	0.000
Race/ethnicity	0.029	*						
Asian			-0.568		0.091	-0.290		0.157
Black			0.619		0.093	0.558		0.064
Latino/a			-0.064		0.734	0.282		0.061
White			Ref			Ref		
Other			-0.268		0.301	-0.143		0.477
Caregiver / Household								
Household income	0.000	***						
< $25,000			1.306	***	0.000	0.036		0.878
$25,000 – $49,999			0.813	**	0.006	-0.283		0.200
$50,000 – $74,999			0.768	**	0.005	-0.469	*	0.032
$75,000 – $99,999			0.204		0.551	-0.284		0.167
$100,000 – $149,999			Ref			Ref		
$150,000 – $199,999			-0.153		0.674	-0.626	**	0.003
≥ $200,000			0.810	**	0.005	-0.186		0.401
Chose home: Convenient to school	0.000	***						
No			Ref			Ref		
Yes			0.381		0.075	0.555	***	0.000
Chose home: School system	0.024	*						
No			Ref			Ref		
Yes			0.476	**	0.007	0.114		0.395
Parent with college degree (1+)	0.001	**						
No			Ref			Ref		
Yes			-0.696	***	0.000	0.080		0.606
Trip / Transportation								
Distance home-to-school (miles)	0.000	***						
<0.5 mi.			Ref			Ref		
0.5–0.99 mi.			1.029		0.089	-1.542	***	0.000
1.0–1.49 mi.			1.006		0.112	-2.363	***	0.000
1.5–1.99 mi.			1.803	**	0.004	-3.434	***	0.000
2.0–2.99 mi.			2.001	**	0.001	-3.758	***	0.000
3.0–4.99 mi.			2.579	***	0.000	-3.853	***	0.000
≥5 mi.			3.138	***	0.000	-4.201	***	0.000
Trip time	0.000	***						
AM			Ref			Ref		
PM			0.345	***	0.000	0.510	***	0.000
Trip season	0.098							
Fall			Ref			Ref		

Variable	Wald P>F		School Bus Coeff		School Bus P>z	Walk or Bike Coeff		Walk or Bike P>z
Winter			0.289		0.107	-0.222		0.130
Spring			-0.116		0.554	0.008		0.956
Household vehicle status	0.088							
Zero vehicles			1.081		0.105	1.344	*	0.025
Vehicle deficit			0.353		0.155	0.252		0.219
Vehicle+ per driver			Ref			Ref		
School Characteristics								
School program type	0.000	***						
Neighborhood zone			Ref			Ref		
Public choice			-1.702	***	0.000	-0.332	*	0.026
Private choice			-1.459	***	0.000	-1.720	***	0.000
Built Environment								
California metro area	0.000	**						
Not in major metro			Ref			Ref		
Greater Los Angeles			-0.895	**	0.001	-0.542	**	0.005
Sacramento			-0.569	**	0.013	0.170		0.348
San Diego			-1.145	**	0.002	0.227		0.287
San Francisco Bay Area			-0.865	*	0.012	0.075		0.717
San Joaquin Valley			0.260		0.275	-0.203		0.419
Neighborhood type (Urbanicity)	0.000	***						
Urban			0.485		0.328	0.839	**	0.001
Suburban			Ref			Ref		
Rural or Small town			0.862	***	0.000	-0.057		0.825
Constant			-3.915	***	0.000	0.290		0.283

n = 4,368   * P < 0.05   ** P < 0.01   *** P < 0.001

Standard errors clustered by individual to account for AM and PM trips for each student.

Omitted from model for parsimony: Gender, Siblings, Household structure, Homeownership, Foreign-born parent (1+), Parent medical condition (1+), Parent flexible schedule (1+), Travel day of week, Walkability, High-quality transit access, School demographics, School achievement levels, State HTST Fund allocations per pupil

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