REACH

National Center *for* Research on Education Access and Choice

Another One Rides the Bus: The Impact of School Transportation on Student Outcomes in Michigan

Danielle Sanderson Edwards, Brown University

Technical Report
Published May 27, 2022

Another One Rides the Bus: The Impact of School Transportation on Student Outcomes in Michigan

Danielle Sanderson Edwards
Postdoctoral Research Associate
Brown University

Abstract
School transportation may increase student outcomes by providing a reliable and safe means of getting to and from school. Little evidence of the effects of such policies exists. In this paper, I provide some of the first causal evidence of transportation impacts on student attendance and achievement using a rich panel of student-level enrollment and address data for Michigan public school students and a unique dataset of district transportation policies for the largest 50 districts in Michigan. I exploit the walking distance cutoffs that determine transportation eligibility using a regression discontinuity design. I find that transportation eligibility increases attendance rates and lowers the probability of chronic absence. These effects are largest for economically disadvantaged students, who experience 0.5 to 1 percentage point increase in attendance rates and a 2 to 4 percentage point decrease in the probability of being chronically absent. These results are compelling evidence that school-provided transportation increases attendance for students most at-risk to miss school. However, I find no effect of school transportation on student achievement outcomes. Given the high costs of school transportation, targeting additional transportation services to chronically absent students as an attendance intervention may be more efficient than increasing bus services for all students.

ACKNOLWEDGEMENTS: I thank Olivia Czajka and Mallory Weiner for their assistance in compiling the transportation policies used in this research. I also thank Josh Cowen, Amy Ellen Schwartz, Scott Imberman, Samantha Trajkovski, Sarah Cordes, and Jane Lincove for their helpful comments and suggestions.

DISCLOSURE OF FUNDING: The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305C180025 to The Administrators of the Tulane Educational Fund. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

Introduction

Since 1869, some public school districts have provided students transportation to school to ensure consistent attendance and allow districts to consolidate (McDonald and Howlett 2007). Today, over 25 million children, about half of U.S. public school students, ride a school bus to and from school. During the 2015-16 school year, school districts spent over $24 billion on student transportation nationally, about $1,000 per student transported—constituting approximately eight percent of average per pupil expenditures (National Center for Education Statistics 2019). To reduce the high costs of the school bus, districts have cut school bus routes, provided public transit passes, contracted with rideshare companies, halted bus service altogether, and in some states, charged parents for transportation services in recent years (Bergal 2015; Cornwall 2018).

Decreasing the availability of district-provided transportation may be detrimental to student outcomes. School transportation might positively affect school attendance, an increasingly important outcome, by providing a reliable, consistent, and safe mode of transportation. This removes the logistical and financial burdens of school transit from parents, making it easier for students to get to school regularly, increasing how often they attend school. These burdens may be especially prohibitive for low-income families because they are more likely to live in neighborhoods that are unsafe to walk through, have little access to car or any form of direct transportation, and be chronically absent, commonly defined as missing more than ten percent of possible school days (Sampson, Raudenbush, and Earls 1997; Balfanz and Byrnes 2012; Urban Institute Student Transportation Working Group 2018). In addition to increasing attendance, school transportation may raise student achievement because school attendance has a positive effect on student achievement and is positively associated with on-time graduation and socio-emotional outcomes (Gottfried 2010, 2011, 2014b; Aucejo and Romano 2016; Gershenson, Jacknowitz, and Brannegan 2017; Kirksey 2019).

On the other hand, riding the school bus may have some detrimental effects of its own. Early bus pick-up times and long commutes may mean less time to sleep and complete homework, negatively affecting achievement. Further, families that rely on the school bus may be hesitant to use it at times due to safety concerns associated with waiting at the bus stop. Bullying, fighting, and other undesirable social behaviors that may take place on the bus also could deter students from attending school and damage their mental health and engagement in school, in turn, decreasing achievement (Arseneault, Bowes, and Shakoor 2010; Ladd, Ettekal, and Kochenderfer-Ladd 2017).

Although school transportation may influence student attendance and achievement, little research examines the relationship between the school bus and student outcomes. A handful of recent studies show that riding the school bus is positively associated with attendance (Gottfried 2017; Cordes et al 2019; Gottfried, Ozuna, and Kirksey 2021) with one study finding negative effects of transportation eligibility on absences (Pogodzinski et al 2021). These studies use student-level covariates and school-level fixed effects to attempt to control for unobserved characteristics that are determinants of attendance and are correlated with riding the school bus. However, their results may be biased because they cannot account for families' decisions concerning where they live in relation to the school their children attend, which may be associated with using school transportation as well as student outcomes.

I add to this literature by providing some of the first plausibly causal estimates of transportation eligibility on student outcomes by exploiting the walking distance cutoffs that determine student eligibility for the school bus using a regression discontinuity design. In combination with the use of student address data and school-by-grade-by-year fixed effects, my research design allows me to account for unobserved characteristics in the error term associated with riding the school bus and provide suggestive evidence that transportation eligibility does not influence residential decisions or choice of school. Thus, the only difference between students who live on opposite sides of the cutoff that influences student outcomes should be transportation eligibility. Because my treatment is school bus eligibility, my estimates are the intent-to-treat (ITT) effects of riding the school bus, a policy-relevant estimate of school transportation because policymakers can only control who is eligible for transportation and cannot force students to ride the bus.

Specifically, I estimate the effects of transportation on students' attendance rates, an indicator for chronic absenteeism, and standardized math and English Language Arts (ELA) test scores using a rich panel of statewide, student-level enrollment records, achievement, and address data as well as a unique dataset of local transportation provisions I collected from the 50 largest districts in Michigan. Furthermore, I examine how transportation effects differ for students from low-income families because I hypothesize that they may be more reliant on school transportation to get to and from school regularly.

I find that transportation eligibility increases attendance rates for economically disadvantaged students by almost two-thirds of a percentage point, the equivalent of approximately one day in a 180 day school year. Similarly, transportation eligibility decreases the probability of being chronically absent for low-income students by two to four percentage points. I find little evidence that transportation eligibility affects attendance for students who are not economically disadvantaged, and I detect no significant effects of the school bus on student achievement. These findings imply that school transportation is likely most important for students who would not attend school as frequently without a safe and reliable mode of transportation. In terms of policy, increasing the number of bus routes or students eligible for transportation to curb chronic absenteeism may not be very efficient given the high costs of operating school buses and the concentrated effects for at-risk students. Rather, targeting additional transportation services to chronically absent students who report lack of transportation as a barrier to getting school may be beneficial and more cost-effective.

Background: The Policy Relevance of Student Attendance

Over the last decade, there has been an increased focus on reducing student absenteeism to improve student outcomes. It is well-established that school attendance is strongly associated with student achievement and educational attainment with some causal evidence suggesting that absences decrease student test scores (Gottfried 2009, 2010, 2011, 2019; Aucejo and Romano 2016; Gershenson, Jacknowitz, and Brannegan 2017; Kirksey 2019). In particular, chronic absenteeism, commonly defined as missing more than ten percent of days in a school year, is particularly detrimental to school performance. Students who are chronically absent have lower levels of academic achievement, are less eager to learn, and are less likely to graduate on time (Allensworth and Easton 2007; Chang and Romero 2008; Gottfried 2014b). Chronic absenteeism not only affects those who miss school, but their classmates. An increase in the percent of classmates who are chronically absent is associated with lower test scores (Gottfried 2019).

In addition to student outcomes, chronic absenteeism can negatively impact district budgets and school performance on state accountability systems. In seven states, including California and Texas, the amount of funding a district receives is tied to their average daily attendance (Baker 2014). In Michigan, the setting of this study, districts only receive funds for the instructional days they have over 75 percent of students enrolled in attendance (MI Sec

388.1701). Thus, districts risk losing funding when they have high chronic absenteeism rates. Additionally, schools likely face state intervention if they have high chronic absenteeism rates in most states. Under the Every Student Succeeds Act (ESSA), states are required to report chronic absenteeism rates on state report cards. Furthermore, over 70 percent of states chose to incorporate it into their state accountability system, including Michigan (Bauer et al 2018).

Although schools are held accountable for chronic absenteeism in addition to student achievement and attainment, family characteristics and environmental factors largely influence these outcomes (Lenhoff and Pogodzinski 2018). Prior research finds a strong, positive relationship between poverty and absences (Ready 2010; Balfanz and Byrnes 2012; Gottfried 2014a; Morrissey, Hutinson, and Winsler 2014; Dougherty 2018). Access to health care, housing instability, neighborhood crime, car ownership, and access to public transit may influence low-income students' abilities to attend school regularly (Baker 2014; Lenhoff and Pogodzinski 2018). For example, low-income students are more likely to miss school because of chronic health conditions (Meng, Babey, and Wolstein 2012; Bauer et al 2018). Additionally, district-level chronic absenteeism rates are higher in cities with high rates of asthma, violent crime, cold weather, and residential vacancy (Singer et al 2021).

Another environmental factor that may negatively impact attendance is distance to school. Less than ten percent of students who live more than a mile away from their school walk or bike to school (Federal Highway Administration 2019). Therefore, students who live farther from school likely rely on a car, bus, or train to transport them to school. Because families who live in high poverty neighborhoods are less likely to own a car, distance likely inhibits low-income students from attending school unless they have access to public or school transportation (Urban Institute Student Transportation Working Group 2018). In fact, research on commute times and absenteeism in Washington, D.C., and Baltimore, two cities with high percentages of low-income students, finds that students with longer commutes have higher rates of absenteeism (Blagg, Rosenboom, and Chingos 2018; Stein and Grigg 2019).

How Can School Transportation Affect Attendance and Achievement?

One school resource that could mitigate the effects of distance to school and other familial and environmental factors that negatively impact school attendance is publicly provided school transportation. School buses can reduce the difficulty of traveling to and from school. First, they remove the logistical and financial burdens of transporting students to school from parents. Without school or public transportation, parents must have access to transportation, have adequate time to take their child to and from school, and be able to afford any additional expenses that the commute incurs. These burdens may be especially prohibitive for low-income families because they are less likely to have reliable access to transportation and adequate time or money to transport their children to school. Second, the school bus provides a daily routine. Research shows that having routines reduces stress in students (Wolin and Bennett 1984). If the school bus provides families a routine by having a reliable and consistent mode of transportation, it could reduce stress, increasing positive attitudes towards going to school, leading to higher attendance (Gottfried 2017). Finally, school buses offer a safer way to get to school. If students must walk through dangerous neighborhoods or brave extreme weather conditions to get to school, they may not go to school. Although students riding the school bus may still have to weather some of these conditions as they wait at and walk to their bus stops, school buses may lower their exposure to unsafe travel environments by providing a safe and reliable mode of transportation, making it easier for students to get to school on a regular basis.

In addition to raising attendance rates, school transportation can affect student achievement. The most direct way that school transportation can change achievement is by increasing attendance. Because I hypothesize that school transportation raises attendance rates, and it is well established that regular attendance increases test scores, it follows that school transportation could have a positive effect on achievement as well. However, riding the school bus could have negative effects on achievement independent of its effects on attendance. For example, riding the school bus could decrease test scores if bullying, fighting, and other undesirable social behaviors take place on the bus. Furthermore, long bus rides and early bus pick up times could harm student achievement by reducing the time students have to do homework, participate in extra-curricular activities, or sleep. However, little empirical evidence exists establishing a change in test scores due to long commutes to school (Blagg, Rosenboom, and Chingos 2018).

Prior Research on School Transportation and Student Outcomes

The majority of research concerning district-provided transportation finds a positive association between transportation and attendance. In Baltimore, incidences of violent crime decrease attendance for 9th graders who walk through the neighborhoods where the crimes occur. However, there is no change in attendance when students use a district-provided bus pass to ride the public bus through the same neighborhoods (Burdick-Will, Stein, and Grigg 2019). This implies that by providing a safe mode of transportation, districts may mitigate some of the negative effects of traveling to school. Furthermore, riding the school bus in kindergarten is associated with increased attendance, especially for students living in rural communities (Gottfried 2017; Gottfried, Ozuna, and Kirksey 2021). Similarly, school bus riders in New York City have higher attendance rates and are less likely to be chronically absent. However, differences in attendance between students who ride the bus and those who do not are explained by student and school characteristics, implying that riding the bus may allow students to attend better schools rather than directly increase attendance (Cordes et al 2019). Additionally, one recent study found negative associations between attendance rates and transportation eligibility in Detroit (Pogodzinski et al 2021). To my knowledge, there is little evidence concerning the relationship between school buses and achievement.

Although these studies attempt to account for student, school, and district characteristics through covariates and fixed effects, it is likely that there are unobserved characteristics in the error term that are correlated with riding the school bus biasing the effects of the school bus. I add to these studies by providing some of the first causal evidence of these effects on attendance and achievement. Specifically, I use a regression discontinuity design that compares the outcomes of students who live on opposite sides of the walking distance cutoff that determines whether the district provides transportation. Also, I account for differences in choice of school and residence by restricting the sample to students who attend their nearest traditional public school in the district where they reside, my proxy for assigned school, and through the use of school-by-grade-by-year fixed effects. Further, I provide evidence that suggests that families do not systematically choose their school or residence based on the availability of school provided transportation using balance and manipulation tests. Thus, the only plausible difference between these two groups is that one is transportation-eligible, and one is not, conditional on choice of school, allowing me to estimate an unbiased impact of school transportation on student outcomes.

School Transportation in Michigan

According to state law, Michigan school districts are not required to provide transportation to general education students but may choose to do so at their discretion (MI Sec 380.1321). Although most school transportation decisions are made at the local level, there exist state laws that regulate how transportation is provided and to whom if traditional public school districts offer it to their residents. First, the decision to provide transportation must be made at the elementary, middle, or high school level. For example, if a district offers transportation to one elementary school, they must offer it to all elementary schools. Second, districts that provide transportation must offer it to resident students who attend the public school "which they are eligible to be admitted" and live more than 1.5 miles from that school (MI Sec 380.1321). It is up to interpretation whether this means that districts only have to provide transportation to students who attend their assigned school or all schools in the resident district that the student is eligible to attend. However, many districts state that they only provide transportation to the assigned school. Additionally, some districts offer transportation to students who live closer to their school than the 1.5 mile state mandated cutoff. Finally, Michigan districts cannot charge resident students for transportation (MI Sec 380.1321). Although there are some state funds for transportation expenses, most school transportation costs are covered by districts' operational budgets (MI Sec 388.1674).

School Choice and Transportation

In addition to affecting student attendance and achievement, school-provided transportation can facilitate participation in school choice programs (Trajkovski, Zabel, and Schwartz 2021). This is particularly salient in Michigan where one out of five public school students participate in either inter-district or charter school choice (Edwards 2021). Few regulations exist concerning the provision of transportation for students using inter-district or charter school choice. Michigan charter schools are not required to provide transportation to their students. If they choose to do so, to whom it is provided to is completely at their discretion (Michigan Department of Education 2017). Little knowledge exists concerning the provision of transportation by charter schools throughout Michigan. However, Singer et al (2020) finds that about one quarter of Detroit charter schools and less than 10 percent of charter schools in the Detroit suburbs provide transportation to any of their students. Most charter schools in their study that do offer transportation also have geographic and space limitations that restrict access to transportation.

Similar to charter schools, districts are not required to provide transportation to students participating in inter-district choice but may choose to do so. Further, districts can charge students using inter-district choice for transportation services (Michigan Department of Education 2013). Less than half of Michigan districts offer any transportation to non-resident students. The districts that do offer transportation to students using inter-district choice are predominantly located in rural areas of the state (Edwards and Cowen 2020).

Data

To estimate the effects of school transportation on student attendance and achievement, I primarily use student-level records from the Michigan Department of Education (MDE) and the Center for Educational Performance and Information (CEPI), and transportation policies collected from the 50 largest school districts in Michigan. The student-level records include enrollment and demographic information (e.g. race and ethnicity, gender, disability status, English Learner status, and economically disadvantaged status), the total number of days the student attended school during the school year, the number of days the student could have attended school, test scores on state standardized exams (either the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP), and student addresses geocoded at the census block level for all Michigan public school students from the 2012-13 school year to the 2018-19 school year. I also use publicly available school-level records that include the school's address, educational settings, and grades offered.

District Transportation Policies

As described above, school transportation in Michigan is at the discretion of local districts. There is no centralized state-administered data resource on individual district policies, so local nuances must be collected directly at the district level. I collected district transportation policies for the 50 largest traditional public school districts in Michigan from district websites and bylaws during Fall 2019. The largest districts were determined by enrollment during the 2017-18 school year, the most recent year of student-level data available at the time of collection. These 50 districts account for nine percent of Michigan districts but educate one-third of all public school students in the state. I coded the policies for the date they were last changed, eligibility requirements, the modes of transportation offered, and any restrictions on the provision of transportation. In particular, I collected information concerning the walking distance cutoffs that determined school transportation eligibility. I use these cutoffs as a form of exogeneous variation to estimate the causal effects of the school bus.

In Table 1, I examine variation in transportation policy provisions across districts in my sample. I consider differences by schooling level because Michigan law requires that decisions regarding the provision of transportation be made at the elementary, middle, and high school levels. All but one of the districts in my sample offer transportation and all but two districts in my sample only offer yellow bus transportation. For these reasons, I focus on the districts that offer the school bus in my analysis. Therefore, the results of my analysis can be interpreted as the effects of the school bus on student outcomes. I also examine the prevalence of two types of restrictions on school bus eligibility in Table 1: attendance at assigned school and walking distance cutoffs. Twenty-two districts in my sample explicitly stipulate that a student is only offered district-provided transportation if they attend their assigned school. However, the absence of the assigned school provision does not mean that the other districts in the sample provide transportation to all schools in the district. They may rely on the language in the state law concerning “eligible to be admitted” to only offer transportation to the assigned school.

Thirty-four districts in my sample state the exact walking distance cutoff that determines transportation eligibility. In elementary school, three out of four (27) districts in my sample have walking distances of one or 1.5 miles. In middle and high school, two thirds (23) of districts have walking distances of 1.5 miles, the maximum distance set by the state. Districts who choose a cutoff closer than the state mandated cutoff may do so to minimize or maximize the number of transportation-eligible students. For example, the percent of students eligible for transportation in districts in my sample that have a 0.75 mile walking distance cutoff would increase by 25 percentage points if they changed the cutoff to 0.5 miles from school, likely increasing transportation costs. Thus, I focus on the effects of school transportation in the 23 districts with a 1.5 mile cutoff in my analysis because transportation eligibility, my treatment, is likely to have been manipulated by districts who chose a closer cutoff which could bias my results.

In Table 2, I compare the average district characteristics in the collected and analytic samples to all districts in the state during the 2017-18 school year. Sampled districts are more densely populated because they serve more students and are smaller in land area than the average Michigan district. A higher percentage of sampled districts are located in cities and suburbs.

Also, they have a higher percentage of non-White students, a lower percentage of economically disadvantaged students, and higher average achievement. In particular, districts with walking distance cutoffs closer to the school than 1.5 miles are more likely to be located in suburban areas, serve a higher percentage of Black students, and are smaller in terms of population and land area than districts that use the state-set cutoff to determine transportation eligibility.

Analytic Sample

To construct my sample, I begin with 428,174 student-year observations of students in grades K-8 who have a walking distance cutoff of 1.5 miles and attend their nearest school offering their grade in their resident district, my proxy for assigned school, between the 2012-13 and 2018-19 school years.[1] It is likely that students are only guaranteed transportation to their assigned school because 22 of the 50 of the district transportation policies I collected explicitly stated that students were only guaranteed transportation to their assigned school. Also, I cannot guarantee that districts that do not have this provision in their transportation policy do not limit transportation eligibility to a student's assigned school because districts may rely on the language in the state law or use their discretion to do so. Even if a district offers transportation to all schools in the district, they must offer it to their assigned school as well. Therefore, by restricting the sample to students who likely attend their assigned school, I am ensuring all students in my sample are transportation-eligible if they live more than 1.5 miles from school.

---

[1] To determine a student's nearest school, I first determine which district the student lives in using the population weighted centroid of their resident census block and district boundary shape files from the Michigan Department of Technology, Management, and Budget. Then, I calculate the geodetic ("as the crow flies") distance from their census block to each school in their resident district that offers general education and the student's grade excluding virtual schools, boarding schools, and other residential schools. I use the school with the shortest distance as their nearest school. To examine whether nearest school is a good proxy for assigned school, I determine what percent of students who attend their nearest school attend their assigned school for the one district for which I have school catchment zone data (for one school year). Eighty-five percent of students who attend their nearest school attend their assigned school. Thus, it is likely that students in my sample attend their assigned school and are eligible for the school bus.

I exclude 2,333 (0.5%) student-year observations of homeless students and 44,760 (10.5%) student-year observations of students with disabilities from my sample because they may receive school transportation regardless of distance between home and school. Under the McKinney-Vento Act, districts are required to transport homeless students to their school of origin (U.S. Department of Education 2018). Students with disabilities are guaranteed transportation if their Individualized Education Program (IEP) Team deems it as a necessary service (U.S. Department of Education 2009). Although the number of students with disabilities whose IEPs include the provision of transportation may vary by district, existing evidence shows that a large percentage of students with disabilities receive transportation services regardless of whether it is specified in their IEP (Sattin-Bajaj 2018). Thus, I drop all students with disabilities from my sample.[2] My final analytic sample includes 380,909 student-year observations.[3]

Treatment and Forcing Variables

I use a strict regression discontinuity design that leverages the walking distance cutoff to estimate the effects of transportation eligibility on student attendance and achievement outcomes. This design assumes that, local to the cutoff, the average student on either side of the cutoff is identical, with one exception: one side is eligible for transportation and the other is not. Thus, any estimated differences in outcomes can be attributed to transportation eligibility as long as families do not choose their residence based on transportation eligibility and there is nothing other than the outcomes that change discontinuously at the cutoff. I consider my estimates to be

[2] My data include special education services provided. However, few students have transportation reported as a necessary service. According to an interview with a Detroit Public Schools Community District administrator, about sixty percent of special education students received door-to-door transportation to any school in the district during the 2017-18 school year (Sattin-Bajaj 2018). Although DPSCD transported over 3,300 students with disabilities, significantly fewer students had transportation reported as a necessary service in the administrative data during the 2017-18 school year. Therefore, I have no indication in the data concerning which students with disabilities receive transportation and choose to drop them all to ensure they do not bias my results.
[3] Also, I exclude 172 observations of students who do not have reported attendance variables.

the intent to treat (ITT) effects of riding the school bus because I use transportation eligibility rather than bus ridership to determine treatment because I do not have data concerning which students actually ride the bus on a daily basis. Because I consider possible non-compliers—those eligible for transportation but do not ride the bus—as treated, my estimates are likely biased towards zero. These ITT effects can be considered just as policy relevant as the average treatment effect on the treated because policymakers cannot force students to use a bus. Instead, they can change who is eligible for transportation to either encourage or restrict school bus use. Therefore, the true impact of changes to transportation policies likely includes compliers and non-compliers making the effect of transportation eligibility, the ITT effect, a policy relevant estimate.

Students are considered transportation-eligible if they live more than 1.5 miles walking distance from school. Walking distance, my forcing variable, is calculated from the population weighted centroid of the student's home census block to the exact address of their attended school.[4] I calculate walking distances, in miles, using Here Application Programming Interface (API), a similar tool to Google Maps, using the quickest route assuming average traffic.[5] Because I do not have any data concerning who districts consider transportation-eligible, I

[4] Because I use the population weighted centroid of the student's home census block to calculate walking distance to school rather than the student's actual address, there may be some measurement error in determining treated and untreated students. Although I believe the size of this measurement error to be small because the estimated size of the median census block in my sample is less than 0.1 square mile, I ensure that my results are not driven by measurement error by estimating my main models on the sample of students who live in census blocks that likely lie completely on one side of the cutoff. To help determine which blocks likely lie completely on one side of the cutoff, I calculate the geodetic distance between the census block's population weighted centroid and the nearest block's population weighted centroid. Assuming that the population weighted centroid of a census block is closer to all the points within the census block than the centroid of the nearest census block, I consider all census blocks who are farther from the walking distance cutoff than the centroid of nearest census block as lying completely on one side of the cutoff or the other. Results of this model are similar to the results of the main models and other robustness checks. They can be found in Appendix Table A1.

[5] If school or census block coordinates are not located on a road, Here API snaps the coordinates to the nearest road possibly creating some error in the distance calculations. Because census block centroids are more likely to fall far from a road in rural areas, I estimate my main model using a sample that excludes the students living in rural areas form my sample. Results are similar and available by request.

assume that walking distance perfectly predicts treatment. However, bus eligibility cutoffs may not be strictly applied. In addition to students who are eligible for the bus but choose not to ride it, some students who are not eligible for transportation as determined by walking distance may receive special treatment and ride the bus. Parents may be able to advocate for their students to ride the bus even if they are not eligible. Schools may make exceptions for students who have dangerous walking commutes to school. In this case, I consider ineligible students who ride the bus as not treated because I do not have data from each district concerning bus ridership. Thus, I likely underestimate the effects of riding the school bus on student outcomes because I include possible non-compliers—those that are ineligible for transportation but ride the bus—as not treated.

Attendance and Achievement Measures

I estimate the effects of school bus eligibility on student attendance and achievement. I use two measures of attendance: the student's annual attendance rate and an indicator for being chronically absent. I calculate the attendance rate using the rules set out by CEPI. I divide the number of days the student attended the school by the number of days that the school reported that the student could have possibly attended that specific school based on the number of days they were enrolled at that school. If the students attended multiple schools during the same school year, I use the student's primary school of attendance as determined by CEPI. Because I theorize that the school bus increases attendance by lowering the financial and time costs associated with transporting students to and from school, I hypothesize that transportation eligibility may increase the likelihood that a student attends school on a regular basis rather than marginally increasing attendance. Therefore, I also use an indicator for being chronically absent as an outcome. I consider a student to be chronically absent if their attendance rate is less than 90 percent, which is MDE's definition of chronic absence (Center for Educational Performance and Information 2021). I note that students who transferred schools midyear are not automatically considered chronically absent because attendance is calculated using the number of days the student was enrolled in the school rather than the total number of days in the school year. I measure achievement using test scores on the state standardized exam, the MEAP or the M-STEP, for students in grades 3 through 8. Specifically, I use math and ELA test scores standardized within grade, subject, and year.

Table 3 examines differences in characteristics and outcomes between transportation-eligible and ineligible students in my full and analytic samples. I restrict my analytic sample to students who live within 0.4 miles of the cutoff, my preferred bandwidth for estimating causal effects. The choice of preferred bandwidth is informed by optimal bandwidth procedures described by Calonico, Cattaneo, and Titiunik (2014). Almost half of students in my sample are transportation-eligible. A lower percentage of English Learners, White, and economically disadvantaged students are transportation-eligible in the full sample. However, there are few differences between transportation-eligible and ineligible students in my analytic sample. As for attendance rates, transportation-eligible students have slightly higher attendance rates than students who are not. These differences are similar for students who live within 0.4 miles of the cutoff. Additionally, transportation-eligible students have higher test scores, but this difference is much smaller within my preferred bandwidth.

Method

I estimate the effects of school bus eligibility on student attendance and achievement using a strict regression discontinuity design. Specifically, I exploit the walking distance cutoffs that determine eligibility for district transportation. I estimate:

$$Y_{igjt} = \beta_1 + \beta_2 Eligible_{ijt} + f(distance_{ijt}) + \boldsymbol{X_{it}\beta} + \gamma_{gjt} + \varepsilon_{igjt} \quad (1)$$

Where Y_{igjt} is one of the following four outcomes for student *i* in grade *g* who attends nearest school *j* in year *t*: attendance rate, an indicator that equals one if student *i* is chronically absent, standardized math test score, or standardized ELA test score. $Eligible_{ijt}$, my treatment indicator, equals one if student *i* is eligible to receive transportation to school *j* in year *t.* Students in my sample are school bus eligible if they live more than 1.5 miles from school. $f(distance_{ijt})$ is a flexible function of the walking distance from student *i*'s home to their school *j* in year *t*, my forcing variable. I use a linear term of my forcing variable and its interaction with my treatment, $Eligible_{ijt}$ in my preferred models. $\boldsymbol{X_{it}}$ contains student characteristics including race, gender, economically disadvantaged status, and English Learner indicators. In the models where math or ELA test score is the outcome, I include a lagged test score in my vector of student characteristics to account for prior achievement.

Transportation eligibility, school characteristics, and neighborhood characteristics are likely correlated with each other and my outcomes. Therefore, my estimated effects of school bus eligibility would be biased if I do not account for students' schools and neighborhoods. In fact, Cordes et al (2019) find that most differences in attendance between students who ride the bus and those who do not in New York City are due to differences in the schools they attend. To ensure that where students choose to attend school does not bias my estimates, I include, γ_{gjt}, a grade-by-school-by-year fixed effect in my preferred models.[6] This ensures that my estimates are created by only comparing students who attend the same school and the same grade during the

[6] Variation in transportation eligibility exists in 72 percent of school-grade-year combinations and in all district-grade-year combinations. Over 90 percent of my sample contributes to my estimates of the effects of transportation eligibility. The identifying sample of students is similar to the full analytic sample.

same school year. Because I restrict my sample to students who attend their nearest school, my proxy for assigned school, γ_{gjt} not only holds constant school characteristics but neighborhood characteristics as well, accounting for choice of school and home. Furthermore, the grade-by-school-by year fixed effects account grade and year specific trends. I cluster my standard errors by school.

To produce causal estimates of the effects of transportation eligibility using a regression discontinuity design, I must limit my sample to observations local to the cutoff. Thus, I estimate Equation 1 on the sample of students who live within 0.4 miles of the walking distance cutoff, my preferred bandwidth. My choice of bandwidth is informed by the optimal bandwidth procedures proposed by Calonico, Cattaneo, and Titiunik (2014). Additionally, I hypothesize that district-provided transportation has larger effects for low-income students because they are less likely to have access to direct forms of transportation and they are more likely to live in unsafe neighborhoods (Sampson, Raudenbush, and Earls 1997; Urban Institute Student Transportation Working Group 2018). Therefore, they may be more likely to rely on schools to provide a reliable and safe way to get to school. To test this hypothesis, I also estimate the model represented by Equation 1 on samples restricted to either economically advantaged or disadvantaged students, my poverty indicator. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Validity of Design

For my research design to estimate the causal effect of school bus eligibility, two assumptions must hold. First, I must assume that families do not manipulate themselves into treatment, meaning that they do not choose their residences based on school bus eligibility. If families do manipulate themselves into treatment, it is likely that there are unobserved characteristics correlated with treatment biasing my estimates of transportation eligibility. Although school bus eligibility rules are publicly available, families may be more focused on which school their children would be assigned to attend rather than whether they would be eligible for the school bus when choosing a home. To provide evidence that families do not choose residences based on transportation eligibility, I first visually check for discontinuities in the density of observations using histograms of the frequency of observations around the cutoff. I present these histograms in Figure 1. In Figure 1 Panel A, I use a bin size of 0.01 miles and find that there is a large number of observations between 1.5 and 1.51 miles from the cutoff. Taken by itself, this could imply that families are choosing homes right over the cutoff in order to receive treatment. However, there is little difference in the number of observations on either side of the cutoff when I use a bin size of 0.1 miles in Figure 1 Panel B. When combined, the histograms show that there is some evidence of bunching within 53 feet of the cutoff but little evidence at 530 feet from the cutoff.

Next, I formally test for bunching at the cutoff using the statistical test proposed by McCrary (2008). If there is statistically significant evidence of a discontinuity in the density of observations at the cutoff, then it is likely that families manipulate themselves into treatment. I perform the McCrary test using multiple bandwidths and bin sizes. In addition to the choice of bandwidth, the choice of bin size is important in a McCrary test because it regresses the number of observations within a bin as a function of each bin's midpoint to detect discontinuities in density (McCrary 2008). At my preferred bandwidth, 0.4 miles, and the optimal bin size, 0.004 miles, I find a small, statistically significant, and positive discontinuity in the density of observations (McCrary test statistic 0.063 with st. err. 0.014). However, if I use a bin size of 0.1

miles, I do not detect a statistically significant discontinuity in the density of observations at the cutoff (McCrary test statistic 0.010 with st. err. 0.014). Like the findings of the visual examinations of the histograms, the results of the McCrary test provide evidence of bunching within a hundred feet of the cutoff but not within five hundred feet.

Given these findings, I argue that it is unlikely that this bunching is evidence of manipulation because it is unlikely that families who choose their residence for school bus eligibility can control whether their home is within a hundredth or a tenth of the mile from the cutoff. Rather, this discontinuity is a likely result of an idiosyncrasy of the distribution of residences in the data. To investigate whether the bunching is an artifact of normal residential patterns, I first examine the census blocks within 0.01 miles of the cutoff. Although less than 10 students live in the median census block in a given year in my sample, I find that there is one census block that is two thousandths of a mile from the walking distance cutoff for its nearest elementary school and is home to over 100 students a year. This census block contains a mobile home park with 430 multi-family homes all with the same address (MHVillage Inc. 2021). Because the McCrary test uses local polynomial regressions that weigh observations closer to the cutoff more heavily, this census block likely causes the discontinuity in the density of observations. To explore this, I estimate the McCrary test without the mobile home park census block and find no statistically significant evidence of bunching (McCrary test statistic -0.015 with st. err. 0.014). Furthermore, there is little visual evidence of bunching in the histograms of the frequency of observations when the mobile home park census block is removed as seen in Appendix Figure A1. Therefore, this one census block which exhibits a predictable residential pattern likely drives the bunching.

Although the evidence presented above demonstrates that the small amount of bunching detected at the walking distance cutoff is likely caused by a normal residential pattern, I cannot fully rule out the possibility of manipulation. To address this concern, I exclude 808 student-year observations of students living in this census block from the samples used in the rest of my analyses. Additionally, I estimate the model represented by Equation 1 using a donut regression discontinuity approach as a specification check. Specifically, I exclude observations extremely close to the cutoff, including the mobile home park census block, where there could be possible manipulation. Dropping observations at data heaps produces unbiased estimates of the treatment effect in regression discontinuity designs (Barreca, Lindo, and Waddell 2015).

In addition to assuming that there is no manipulation into treatment, I also assume that nothing other than treatment and outcomes change discontinuously at the cutoff. If other factors change at the cutoff, then my estimate of the effect of transportation eligibility may be biased because my treatment indicator would likely be correlated with unobserved characteristics in the error term. To provide evidence that this assumption likely holds, I first examine whether my treatment, $Eligible_{ijt}$ predicts pre-determined observable characteristics of students in my sample using balance tests. Specifically, I estimate:

$$O_{igjt} = \beta_1 + \beta_2 Eligible_{ijt} + f\left(distance_{ijt}\right) + \gamma_{gjt} + \varepsilon_{igjt} \quad (2)$$

where O_{ijt} is an indicator for one of the following student characteristics for student *i* in grade *g* attending nearest school *j* at time *t*: female, White, Black, Hispanic, Asian, Other Race, economically disadvantaged, or English Learner. I estimate the model represented in Equation 2 on the sample of students who live within 0.4 miles of the walking distance cutoff using either a linear term of $distance_{ijt}$ and its interaction with my treatment, $Eligible_{ijt}$, or a linear term, a quadratic term, and their interactions with treatment. Table 4 displays the coefficients and standard errors for $Eligible_{ijt}$ for each of the outcomes I predict in my balance tests. I find no significant differences in any of my observable student characteristics at the walking distance cutoff, providing some confidence that no other characteristics change discontinuously at the cutoff other than the treatment and the outcomes.[7]

Additionally, families may choose schools based on transportation eligibility. Recent research from New York City, where students have access to many schooling options that offer transportation, finds that school bus eligibility increases the likelihood a student attends that school (Trajkovski, Zabel, and Schwartz 2021). Although I restrict my sample to students who do not participate in school choice programs, this choice may be related to transportation eligibility as well as student outcomes, possibly biasing my results. 10 percent of students whose nearest school is in my sample participate in formal school choice policies. Another 35 percent of students attend a school in their resident district other than their nearest school. To examine whether transportation eligibility predicts attending the nearest school or participating in formal school choice policies, I estimate versions of the model represented by Equation 1 on a sample that includes the current analytic sample as well as students who would be in the analytic sample if they attended their nearest school using two binary outcomes: attending the nearest school and attending a school in their resident district. Results of these models can be found in Table 5. I find no statistically significant relationships between choice of school and transportation eligibility, providing suggestive evidence that families are not choosing schools based on the provision of transportation, on average.

[7] I estimate versions of Equation 2 using various bandwidths. Results are similar and can be found in Appendix Table A2.

Results

Before I present the results of my main models, I display graphs of the unadjusted average attendance and achievement outcomes by distance from school in Figures 2 and 3 to visually examine discontinuities in the outcomes at the transportation eligibility cutoff. In Figure 2 Panels A and B, I detect little visual change in attendance rate in the full sample or the sample of economically advantaged students. However, a different pattern emerges in the attendance rates of economically disadvantaged students in Figure 2 Panel C. For economically disadvantaged students who are not eligible to ride the school bus, there is a negative relationship between distance and attendance rate. This relationship does not exist for transportation-eligible students. Furthermore, there is visual evidence of a discontinuity in attendance rates at the cutoff. Taken together, the evidence from Figure 2 Panel C implies that the school bus not only mitigates the negative effects of distance on attendance for economically disadvantaged students but improves their attendance as well. An analogous pattern emerges in Figure 2 Panels D, E, and F which displays the unadjusted proportion of chronically absent students by distance from the threshold for the full sample and the samples restricted to economically advantaged or disadvantaged students implying that the school bus reduces the probability of being chronically absent. Figure 3 graphs the relationships between distance to school and standardized math and ELA test scores. There is no evidence of large slope changes or discontinuities for any of my samples, implying that transportation eligibility may have no effect on achievement.

Although the evidence provided in Figure 2 shows that economically disadvantaged students who are transportation-eligible have higher attendance rates and are less likely to be chronically absent, it may be biased by unaccounted for student or school characteristics. In Table 6, I present the results of the model represented by Equation 1 using a 0.4 mile bandwidth, providing regression adjusted, causal estimates of the effects of transportation eligibility for the full sample. In Column 1, I show that transportation eligibility increases attendance rates by approximately 0.2 percentage points. This is equivalent to almost a half a day increase in attendance in a 180 day school year. However, this estimate is not statistically significant. Additionally, I detect a small, negative, and statistically significant effect of school bus eligibility on chronic absenteeism in Column 2. Specifically, I find that school bus eligibility decreases the probability of being chronically absent by 1.4 percentage points an almost 20 percent reduction in chronic absenteeism from the baseline rate. In Columns 3 and 4, I present the results for math and ELA test scores. I do not detect a statistically significant effect of transportation eligibility on student achievement.

To examine whether the effects of transportation eligibility are larger for economically disadvantaged students, I estimate the model represented by Equation 1 on samples restricted to either economically advantaged or disadvantaged students. The results of these specifications are displayed in Table 7. I find little evidence that transportation eligibility affects attendance rate or the probability of being chronically absent for economically advantaged students. Instead, I find that the positive effects of school bus eligibility on attendance found in the full sample are driven by the effects for economically disadvantaged students. Specifically, I find that transportation eligibility increases attendance rates for economically disadvantaged students by almost two-thirds of a percentage point. This is equivalent to about one day in a 180 day school year. Moreover, school bus eligibility decreases the probability of being chronically absent for economically disadvantaged students by nearly four percentage points, a 20 to 25 percent reduction. This large effect on chronic absenteeism for economically disadvantaged students provides evidence that school transportation has the greatest impact on students who do not have a reliable, consistent, and safe way to get to school without it. Finally, Table 7 shows little evidence that school bus eligibility has a significant effect on achievement for economically advantaged or disadvantaged students.[8]

Specification Checks

To ensure that my results are not sensitive to my choices in functional form, bandwidth, estimator, and sample, I perform the following specification checks. First, I estimate Equation 1 using various bandwidths and a quadratic polynomial term of distance to school, my forcing variable. Results of these specifications are similar and can be found in Appendix Tables A3 and A4. Second, I use a nonparametric estimator, the optimal bandwidth calculated using the method proposed by Calonico, Cattaneo, and Titiunik (2014), and the robust bias-corrected inference procedures detailed by Calonico, Cattaneo, and Farrell (2020) with district, grade, and year fixed effects to estimate the effects of school bus eligibility on my attendance outcomes.[9] Specifically, I estimate local linear polynomial regressions with a first order polynomial function to construct the estimates and a second order polynomial function to construct the bias correction with triangular kernel functions. Results of these models are displayed in Appendix Table A5. The estimates of transportation eligibility from the nonparametric model are statistically significant and similar in direction and slightly larger in magnitude than the models using a parametric estimator and school-by-grade-by-year fixed effects.

[8] One possible reason that could explain why I detect effects of transportation eligibility on student attendance but not achievement is that effects are concentrated in students in non-tested grades, K-2. To test this hypothesis, I estimated my models on samples restricted to grades K-2 and 3-8 separately. These results do not provide evidence for differential effects of transportation eligibility by grade. Results are available by request.

[9] I use the district, grade, and year fixed effects for the non-parametric models due to computational limitations with the large number of fixed effects in my preferred specification. Furthermore, I was unable to calculate standard errors in the models where standardized test score was an outcome. Therefore, I only display the results of the attendance outcomes in Appendix Table A5.

Finally, I estimate the model represented by Equation 1 on samples that exclude observations within 0.01, 0.05, and 0.1 miles of the cutoff. Although I argue that the discontinuity in the density of observations that I detect at the cutoff is driven by an idiosyncrasy of residential patterns, I use this donut regression discontinuity approach to account for possible manipulation close the cutoff as a robustness check. I present the results of the donut regressions in Table A6. The estimated transportation eligibility effects on attendance rates and chronic absenteeism for economically disadvantaged students are similar in direction and magnitude but lose statistical significance when the sample excludes all observations within 0.1 miles of the cutoff. Taken together, the results of these specification checks show that it is unlikely that my findings are a result of my choices in functional form, bandwidth, estimator, and sample.

Falsification Test

Although my results are robust to many of my specification choices, there may exist unobserved characteristics that are correlated with living 1.5 miles away from the schools in my sample, biasing my estimates. For example, if multi-family housing is located closer to schools while single family homes are more likely to be located past the walking distance cutoff, then my estimates could be biased by the effect of living in single family homes on my outcomes. To provide evidence that it is unlikely that living 1.5 miles away from the schools is correlated with unobserved factors that determine either attendance or achievement, I estimate the model represented by Equation 1 on the sample of elementary school students who attend their nearest school and live in one of the 13 districts in my sample that has a walking distance cutoff of 1.5 miles for middle schools but not for elementary schools. This sample provides an ideal test to falsify my results for two reasons. First, students in the placebo sample are not affected by the 1.5 mile cutoff that determines transportation eligibility in my main sample. Therefore, my main results are likely biased if I detect a significant effect of transportation eligibility when I estimate my model on this sample. Second, the students in my placebo sample are very similar to those in my main sample because they live in the same neighborhoods and could even be in the same families as students in my main sample. Therefore, if there are family or neighborhood characteristics that are biasing my estimates of transportation eligibility, they should affect my placebo sample as well because they live in the same neighborhoods as my main sample.

To ensure that students in my placebo sample live in the same neighborhoods as those in my main sample, I use the walking distance from home to the nearest middle school in their resident district as my forcing variable in my falsification test. Therefore, I consider students in my placebo sample as treated if they live 1.5 miles or more from the middle school that they would attend, the same schools that students attend in my main sample.[10] I present the results of my falsification tests for each of my four outcomes for the full sample and the samples restricted to either economically advantaged or disadvantaged students in Table 8. For all outcomes and samples, I do not detect a statistically significant effect of transportation eligibility. Furthermore, most of the estimates are in the opposite direction of the main results. Thus, the results of this falsification test provide evidence that it is likely that no unobserved characteristics associated with living in the neighborhoods in my sample are correlated with my treatment and predict my outcomes, giving more confidence that my models are estimating the causal effect of transportation eligibility.

[10] I also estimate my falsification test using distance from home to the attended elementary school as the forcing variable. The results of this falsification test are similar to the results of the falsification test presented in Table 8 and are available by request. Because the elementary schools may be located in different areas than middle schools, students in the placebo sample considered treated using the distance to the attended school may be less likely to live in the same neighborhoods as the students in the main sample than the students in the placebo sample that are considered treated using the distance to the nearest middle school. Therefore, I prefer distance to middle school as the forcing variable determining treatment in my falsification test.

Discussion

In this paper, I provide some of the first causal evidence of school transportation effects on student attendance and achievement. I find that being eligible for school bus transportation—the intent-to-treat (ITT) estimate of school bus use—decreases the probability of being chronically absent especially for economically disadvantaged students by up to four percentage points. Combined with prior research, my results show that the school bus can mitigate the negative effects of distance to school on attendance for low-income students. In particular, the large effects of transportation eligibility on chronic absenteeism for vulnerable students provide some compelling evidence that school-provided transportation most likely increases attendance for students who would regularly miss school without the school bus, in accordance with my hypothesis.

In contrast, my results do not provide evidence that district-provided transportation affects student achievement. Given that prior research finds that attendance increases achievement (e.g., Gottfried 2011; Aucejo and Romano 2016; Gershenson, Jacknowitz, and Brannegan 2017), the lack of achievement effects is somewhat surprising. However, recent evaluations of attendance interventions, including mentoring programs and information interventions, have found a similar pattern of results: small increases in attendance with no detectable effects on test scores (Rogers and Feller 2018; Guryan et al 2021). The lack of achievement effects of resources and programs that make small increases in attendance is likely attributable to the fact that small increases in attendance lead to only small increases in achievement which may not be detectable in these studies (Rogers and Feller 2018). Specifically, the studies that estimate causal effects of attendance on achievement find that a one day increase in attendance leads to, at most, a 0.01 standard deviation increase in test scores. Thus, for low-income students, the group that experiences the largest increase in attendance from being eligible for the school bus, the estimated increase in achievement from the extra day of school they attend is likely less than 0.01 standard deviation, which my models are unable to detect.

Although the school bus may not affect student achievement, its positive effect on attendance still has important policy implications. Chronic absenteeism can negatively impact district budgets and school performance on state accountability systems. Further, attendance affects other important outcomes not measured in this study including grades, on-time graduation, and school engagement (Liu, Lee, and Gershenson 2021; Kirksey 2019; Gottfried 2014a). However, transportation as an intervention to increase attendance is costly. The cost to operate and maintain a school bus ranges from $34,000 to $38,000 per year (Newby 2019). Thus, increasing bus services for all students may not be cost-effective. Even when I assume that all students riding a bus are chronically absent and low-income, I calculate the cost of one fewer chronically absent student as a result of increased bus services to be over $2,200 given average bus capacity and a 20 percent reduction in chronic absenteeism. This implies that, unless a district has high levels of chronic absenteeism and low-income students, increasing the number of bus routes or the number of students eligible for the bus may not be the most cost-effective way to curb absenteeism. Instead, districts could target additional transportation as an intervention for chronically absent students. If it is identified that getting to school is a barrier to regular attendance for a particular student, schools could choose to provide that student transportation regardless of where they live.

Limitations and Future Directions for Research

Although I provide evidence that transportation eligibility reduces chronic absenteeism for low-income students, more evidence is needed to make strong policy recommendations concerning transportation. First, this study only estimates the intent-to-treat effects of the school bus due to data limitations. Although these effects are policy relevant because policymakers cannot force students to ride the bus, future research that uses bus ridership data can estimate the direct effects of riding the school bus using a fuzzy regression discontinuity design. Second, future studies should examine the effects of the school bus on other important outcomes that are positively associated with attendance. These include disciplinary incidents, student engagement, and socioemotional outcomes. Third, research is needed evaluating the effectiveness of alternative modes of school transportation, including public transit and rides-sharing services. Given the high costs of the school bus, understanding to what extent other provided transportation services have similar effects on student outcomes as the school bus could help determine whether the school bus is the most cost-effective form of school transportation. Fourth, formal cost-effectiveness studies that compare modes of transportation or various walking distance cutoffs are needed to determine whether the benefits of increasing or changing the provision of transportation would offset the high costs of the school bus. Finally, qualitative research is needed to understand how districts design their transportation policies to better understand which policy levers may be the most efficient for increasing equitable access to transit. In conclusion, this paper provides a starting point for future work on school transportation, which I have shown to have meaningful effects on student attendance and chronic absence—an increasingly salient metric for education policy and decision-making.

References

Allensworth, Elaine., and John Easton. 2007. What matters for staying on-track and graduating in Chicago public high schools. *University of Chicago Consortium on Chicago School Research.*

Arseneault, Louise, Lucy Bowes, and Sania Shakoor. 2010. Bullying victimization in youths and mental health problems:'Much ado about nothing'?. *Psychological medicine* 40, no. 5 : 717-729.

Aucejo, Esteban, and Teresa Romano. 2016. Assessing the effect of school days and absences on test score performance. *Economics of Education Review 55*: 70-87.

Baker, Bruce. 2014. Not making the grade: How financial penalties for school absences hurt districts serving low-income, chronically ill kids. A guide for state policymakers. *ChangeLab Solutions.* Available: https://changelabsolutions.org/sites/default/files/School-Financing_StatePolicymakers_FINAL_09302014.pdf. Accessed 2 July 2021.

Balfanz, Robert, and Vaughan Byrnes. 2012. The importance of being in school: A report on absenteeism in the nation's public schools. *The Education Digest 78*(2): 4.

Barreca, Alan, Jason Lindo, and Glen Waddell. 2016. Heaping-induced bias in regression-discontinuity designs. *Economic inquiry 54*(1): 268-293.

Bauer, Lauren, Patrick Liu, Diane Schanzenbach, and Jay Shambaugh. (2018). Reducing chronic absenteeism under the every student succeeds act. *The Hamilton Project, Brookings Institute.* Available https://www.attendanceworks.org/wp-content/uploads/2018/04/Hamilton_project_-reducing_chronic_absenteeism_under_the_every_student_succeeds_act.pdf. Accessed 2 July 2021.

Bergal, Jenni. 2015. School districts are billing parents for bus rides. *Stateline, an initiative of Pew Charitable Trusts.* Available https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2015/6/16/school-districts-are-billing-parents-for-bus-rides. Accessed 2 July 2021.

Blagg, Kristin, Victoria Rosenboom, and Matthew M. Chingos. 2018. The Extra Mile: Time to School and Student Outcomes in Washington, D.C. *Urban Institute.* Available https://www.urban.org/sites/default/files/publication/99027/time_to_school_and_student_outcomes_in_dc_1.pdf. Accessed 2 July 2021.

Burdick-Will, Julia, Marc Stein, and Jeffrey Grigg. 2019. Danger on the way to school: exposure to violent crime, public transportation, and absenteeism. *Sociological Science 6*: 118-142.

Calonico, Sebastian, Matias Cattaneo, and Max Farrell. 2020. Optimal bandwidth choice for robust bias-corrected inference in regression discontinuity designs. *The Econometrics Journal 23*(2): 192-210.

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik. 2014. Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica 82*(6): 2295-2326.

Center for Educational Performance and Information. 2021. MI school data student attendance. Available https://www.mischooldata.org/student-attendance/. Accessed 2 July 2021.

Chang, Hedy, and Mariajosé Romero. 2008. Present, engaged, and accounted for: The critical importance of addressing chronic absence in the early grades. *National Center for Children in Poverty*.

Cordes, Sarah, Michele Leardo, Christopher Rick, and Amy Ellen Schwartz. 2019. Can school buses drive down (chronic) absenteeism? In *Understanding and addressing student absenteeism,* edited by Michael Gottfried and Ethan Hutt. pp.121-136. Cambridge, MA: Harvard Education Press.

Cornwall, Gail. 2018. How lack of access to transportation segregates schools. *Forbes.* Available https://www.forbes.com/sites/gailcornwall/2018/05/01/why-tech-is-prepping-to-overhaul-school-transportation/#6ffe5512588a. Accessed 2 July 2021.

Dougherty, Shaun. 2018. How measurement and modeling of attendance matter to assessing dimensions of inequality. *Journal of Education for Students Placed at Risk. 23*(1-2): 9-23.

Edwards, Danielle. 2021. Over the river and through the woods: The role of distance in participation in rural school choice. *Journal of School Choice.*

Edwards, Danielle, and Joshua Cowen. 2020. All Decisions are Local: How District Rules Can Promote or Restrict School Choices. Available https://www.daniellesandersonedwards.com/wp-content/uploads/2021/04/Schools-of-Choice-Policy-Brief-062620.pdf Accessed 21 March 2022.

Federal Highway Administration. 2019. Children's travel to school: 2017 national household travel survey. *U.S. Department of Transportation.* Available https://nhts.ornl.gov/assets/FHWA_NHTS_%20Brief_Traveltoschool_032519.pdf. Accessed 2 July 2021.

Gershenson, Seth, Alison Jacknowitz, and Andrew Brannegan. 2017. Are student absences worth the worry in US primary schools?. *Education Finance and Policy 12*(2): 137-165.

Gottfried, Michael. 2009. Excused versus unexcused: How student absences in elementary school affect academic achievement. *Educational Evaluation and Policy Analysis 31*(4): 392-415.

Gottfried, Michael. 2010. Evaluating the relationship between student attendance and achievement in urban elementary and middle schools: An instrumental variables approach. *American Educational Research Journal 47*(2): 434-465.

Gottfried, Michael. 2011. The detrimental effects of missing school: Evidence from urban siblings. *American Journal of Education 117*(2): 147-182.

Gottfried, Michael. 2014a. Can neighbor attributes predict school absences?. *Urban Education 49*(2): 216-250.

Gottfried, Michael. 2014b. Chronic absenteeism and its effects on students' academic and socioemotional outcomes. *Journal of Education for Students Placed at Risk 19*(2): 53-75.

Gottfried, Michael. 2017. Linking getting to school with going to school. *Educational Evaluation and Policy Analysis 39*(4): 571-592.

Gottfried, Michael. 2019. Chronic absenteeism in the classroom context: Effects on achievement. *Urban Education 54*(1): 3-34.

Gottfried, Michael, Christopher Ozuna, and J. Jacob Kirksey. 2021. *Exploring school bus ridership and absenteeism in rural communities. Early Childhood Research Quarterly* 56: 236-247.

Guryan, Jonathan, Sandra Christenson, Ashley Cureton, Ijun Lai, Jens Ludwig, Catherine Schwarz, Emma Shirey, and Mary Clair Turner. 2021. The effect of mentoring on school attendance and academic outcomes: A randomized evaluation of the Check & Connect Program. *Journal of Policy Analysis and Management* 40, no. 3: 841-882.

Kirksey, J. Jacob. 2019. Academic harms of missing high school and the accuracy of current policy thresholds: Analysis of preregistered administrative data from a California school district. *AERA Open 5*(3).

Ladd, Gary W., Idean Ettekal, and Becky Kochenderfer-Ladd. 2017. Peer victimization trajectories from kindergarten through high school: Differential pathways for children's school engagement and achievement?. *Journal of Educational Psychology* 109, no. 6: 826.

Lenhoff, Sarah and Ben Pogodzinski. 2018. School organizational effectiveness and chronic absenteeism: Implications for accountability. *Journal of Education for Students Placed at Risk 23*(1-2): 153-169.

Liu, Jing, Monica Lee, and Seth Gershenson. 2021. The short-and long-run impacts of secondary school absences. *Journal of Public Economics* 199: 104441.

McCrary, Justin. 2008. Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of econometrics 142*(2): 698-714.

McDonald, Noreen, and Marc Alan Howlett. 2007. Funding for pupil transportation: framework for analysis. *Transportation research record* (1): 98-103.

Meng, Ying-Ying, Susan Babey, and Joelle Wolstein. 2012. Asthma-related school absenteeism and school concentration of low-income students in California. *Preventing chronic disease*, *9.*

MHVillage Inc. 2021. *Independence Woods.* Available https://www.mhvillage.com/parks/591. Accessed 2 July 2021.

Michigan Department of Education. 2013. Michigan State School Aid Act [MCL 388.1705; 388.1705c; Sections 105, 105c]. Available http://mi.gov/documents/mde/choice1_279579_7.pdf Accessed 21 March 2022.

Michigan Department of Education. 2017. Charter Schools- Questions and Answers. Available https://www.michigan.gov/documents/PSAQA_54517_7.pdf. Accessed 2 July 2021.

MI Sec. 380.1321. Transportation for pupils; requirements; payment. Available http://legislature.mi.gov/doc.aspx?mcl-380-1321. Accessed 2 July 2021.

MI Sec. 388.1674. School bus driver safety instruction; cost of instruction and driver compensation; nonspecial education auxiliary services transportation; inspection costs. Available http://www.legislature.mi.gov/(S(4e0vpo0wmue3nsobxqyhzzwu))/mileg.aspx?page=getObject&objectName=mcl-388-1674. Accessed 2 July 2021.

MI Sec. 388.1701. Eligibility to receive state aid. Available http://www.legislature.mi.gov/(S(xse2efdmzydgfz0ybkfzlgiz))/mileg.aspx?page=getobject&objectname=mcl-388-1701. Accessed 2 July 2021.

Morrissey, Taryn, Lindsey Hutchison, and Adam Winsler. 2014. Family income, school attendance, and academic achievement in elementary school. *Developmental psychology 50*(3): 741.

National Center for Education Statistics. 2019. Digest of Education Statistics, 2018 (NCES 2020-009), Table 236.90. Available https://nces.ed.gov/programs/digest/d18/tables/dt18_236.90.asp. Accessed 2 July 2021.

Newby, Ruth. 2019. Hidden savings in your bus budget. *The School Superintendents Association.* Available. https://www.aasa.org/SchoolAdministratorArticle.aspx?id=7584 Accessed 27 May 2022.

Pogodzinski, Ben, Sarah Lenhoff, Walter Cook, and Jeremy Singer. (2021). School transit and accessing public school in Detroit. *Education and Urban Society*: 00131245211027369.

Ready, Douglas. 2010. Socioeconomic disadvantage, school attendance, and early cognitive development: The differential effects of school exposure. *Sociology of Education 83*(4): 271-286.

Rogers, Todd, and Avi Feller. 2018. Reducing student absences at scale by targeting parents' misbeliefs. *Nature Human Behaviour* 2, no. 5: 335-342.

Sampson, Robert, Stephen Raudenbush, and Felton Earls. 1997. Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science 277*(5328): 918-924.

Sattin-Bajaj, Carolyn. 2018. It's hard to separate choice from transportation. *Urban Institute.* Available https://www.urban.org/sites/default/files/publication/99246/school_transportation_policy_in_practice.pdf. Accessed 2 July 2021.

Singer, Jeremy, Ben Pogodzinski, Sarah Winchell Lenhoff, and Walter Cook. 2020. School transportation policies in Detroit. *Detroit Education Research Partnership.* Available https://education.wayne.edu/detroit_ed_research/7school_transportation_policies_in_detroit_1021.pdf. Accessed 21 March 2022.

Singer, Jeremy, Ben Pogodzinski, Sarah Winchell Lenhoff, and Walter Cook. 2021. Advancing an ecological approach to chronic absenteeism: Evidence from Detroit. *Teachers College Record* 123, 4.

Stein, Marc, and Jeffrey Grigg. 2019. Missing bus, missing school: Establishing the relationship between public transit use and student absenteeism. *American Educational Research Journal 56*(5): 1834-1860.

Trajkovski, Samantha, Jeffrey Zabel, and Amy Ellen Schwartz. 2021. Do school buses make school choice work?. *Regional Science and Urban Economics* 86: 103607.

Urban Institute Student Transportation Working Group. 2018. The road to school: How far students travel to school in Denver, Detroit, New Orleans, New York City, and Washington, DC. *Urban Institute.* Available https://greaterdc.urban.org/sites/default/files/publication/97151/the_road_to_school_7.pdf. Accessed 2 July 2021.

U.S. Department of Education. 2009. Questions and answers on serving children with disabilities eligible for transportation. Available https://sites.ed.gov/idea/files/OMB_08-0101_Transportation-11-4-09_FINAL.pdf. Accessed 2 July 2021.

U.S. Department of Education. 2018. Education for homeless children and youth program non-regulatory guidance. Available https://nche.ed.gov/mckinney-vento/. Accessed 2 July 2021.

Wolin, Steven, and Linda Bennett. 1984. Family rituals. *Family process 23*(3): 401-420.

Table 1: District Transportation Policy Provisions

	Elementary	**Middle**	**High**
Total Districts	50	50	50
Offers Transportation	49	49	49
Must Attend Assigned School	22	22	22
Mode of Transportation			
Yellow Bus	49	49	47
City Bus	0	0	2
Walking Distance Cutoff			
.25 Miles	1	2	0
.5 Miles	5	1	2
.75 Miles	2	1	1
1 Miles	17	8	5
1.5 Miles	10	23	26
No Cutoff	14	14	15

Note. Sample includes the 50 largest traditional public school districts in Michigan in terms of enrollment during the 2017-18 school year.

Table 2: District Characteristics of Sample, 2017-18.

	State	Sample	1.5 Mile Cutoff	Other Cutoff
N Districts	537	50	23	11
Avg. Total Enrollment	2,520	10,856	12,541	10,874
Avg. Sq. Miles	108	65	63	60
City	6%	32%	35%	27%
Suburb	27%	62%	57%	64%
Rural	67%	6%	9%	9%
Avg. Pct. Female	52%	51%	51%	51%
Avg. Pct. White	79%	67%	70%	64%
Avg. Pct. Black	8%	14%	10%	21%
Avg. Pct. Hispanic	7%	8%	9%	5%
Avg. Pct. Asian	2%	6%	6%	7%
Avg. Pct. Other Race	5%	5%	5%	3%
Avg. Pct. Econ. Dis.	55%	39%	37%	32%
Avg. Pct. SWDs	14%	13%	12%	12%
Avg. Pct. ELs	4%	8%	11%	6%
Avg. Attendance Rate	93.05	93.94	94.42	93.73
Avg. Pct. Chronic. Abs.	19%	17%	14%	16%
Avg. Std. Reading Score	-0.02	0.20	0.23	0.29
Avg. Std. Math Score	-0.02	0.21	0.26	0.32

Note. Unweighted district characteristics created using student level data. Econ. Dis., SWD, and EL are abbreviations for economically disadvantaged, student with disabilities, and English Learner respectively. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care. Sample includes the 50 largest traditional public school districts in Michigan in terms of enrollment during the 2017-18 school year. 1.5 mile cutoff includes all districts that have a 1.5 mile walking distance cutoff for at least one grade between grades K-8. Other cutoff districts report a cutoff but it is not 1.5 miles. Attendance rates are from public report made available by the Center for Education Performance and Information. 3 districts with less than 10 students do not have attendance rates available. 24 districts have missing chronic absenteeism rates. One district does not have test scores.

Table 3: Average Student Characteristics of Analytic Sample

	1.5 Mile Cutoff					
	Full Sample			0.4 Mile Bandwidth		
	Full Sample	Not Eligible	Eligible	Full Sample	Not Eligible	Eligible
N	380,909	212,737	168,172	93,281	51,347	41,934
Avg. Walk Distance	1.73	0.77	2.95	1.47	1.30	1.69
Pct. Transport Elig.	44%	0%	100%	45%	0%	100%
Pct. Female	51%	50%	51%	50%	50%	51%
Pct. White	78%	80%	75%	75%	75%	74%
Pct. Black	7%	6%	8%	8%	8%	8%
Pct. Hispanic	6%	7%	5%	6%	7%	6%
Pct. Asian	6%	4%	8%	7%	6%	8%
Pct. Other Race	3%	3%	4%	4%	4%	4%
Pct. Econ. Dis.	37%	47%	26%	32%	33%	31%
Pct. English Learner	17%	25%	7%	11%	11%	11%
Pct. Chronic Absent	7%	7%	7%	8%	8%	7%
Avg Attendance Rate	95.79	95.70	95.90	95.68	95.57	95.83
Avg. Std. Math Score	0.36	0.27	0.46	0.36	0.35	0.37
Avg. Std. ELA Score	0.29	0.21	0.38	0.30	0.30	0.31

Note. Sample includes all student by year observations in analytic sample. 0.4 Mile bandwidth includes all students who have a walking distance from home to school that is between 1.1 miles and 1.9 miles. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school assuming average traffic using Here API. Students are transportation-eligible (Transport Elig.) if their walking distance to school is greater than 1.5 miles. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year. Because students take these tests in grades 3-8, 285,025 and 283,579 student-year observations in my sample have math or ELA test scores respectively.

Table 4: Estimated Coefficients of Transportation Eligibility for Balance Tests

OUTCOMES	(1) Coefficient (SE)	(2) Coefficient (SE)
Female	-0.005	0.008
	(0.011)	(0.016)
White	0.016	0.032
	(0.017)	(0.025)
Black	-0.004	-0.018
	(0.010)	(0.014)
Hispanic	-0.007	-0.014
	(0.008)	(0.010)
Asian	0.002	0.004
	(0.009)	(0.015)
Other Race	-0.007	-0.005
	(0.005)	(0.008)
Econ. Dis.	0.000	-0.035
	(0.017)	(0.026)
EL	0.000	0.000
	(0.011)	(0.014)
Observations	92,566	92,566
WALKING DISTANCE FUNCTIONAL FORM		
Linear Term	X	X
Linear Term interacted with Transportation Eligibility Indicator	X	X
Quadratic Term		X
Quadratic Term interacted with Transportation Eligibility Indicator		X

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include school-by-grade-by-year fixed effects. Standard errors are clustered at the school level. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Econ. Dis. and EL are abbreviations for economically disadvantaged and English Learner respectively. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Table 5: Estimated Coefficients of Transportation Eligibility on Attending Nearest School and Resident District

	(1)	(2)	(3)	(4)
	Attends Nearest		Attends Resident Dist.	
Transportation Eligibility	-0.005	-0.005	0.006	-0.001
	(0.027)	(0.035)	(0.006)	(0.009)
Distance	-0.171**	0.078	-0.025	-0.018
	(0.078)	(0.316)	(0.020)	(0.079)
Distance*Transport. Eligibility	0.065	-0.446	-0.021	0.080
	(0.114)	(0.425)	(0.028)	(0.101)
Distance Squared		0.618		0.018
		(0.771)		(0.204)
(Distance*Transport. Eligibility)^2		0.063		-0.300
		(1.015)		(0.264)
Constant	0.520***	0.537***	0.906***	0.906***
	(0.019)	(0.027)	(0.006)	(0.008)
Observations	178,212	178,212	178,212	178,212
Adj R Squared	0.009	0.009	0.009	0.009

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, economically disadvantaged status, and English Learner covariates and school-by-grade-by-year fixed effects. Standard errors are clustered at the school level. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Students are considered to be transportation eligible if students live farther than 1.5 miles walking distance from their nearest school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their nearest school's address assuming average traffic using Here API. To determine a student's nearest school, I first determine which district the student lives in using the population weighted centroid of their resident census block and district boundary shape files from the Michigan Department of Technology, Management, and Budget. Then, I calculate the geodetic ("as the crow flies") distance to from their census block to each school in their resident district that offers general education and the student's grade excluding virtual schools, boarding schools, and other residential schools. I use the school with the shortest distance as their nearest school. Students who attend their resident district attend a traditional public school within the boundaries of the district they live within.

Table 6: Estimated Effects of Transportation Eligibility on Student Attendance and Achievement

	(1)	(2)	(3)	(4)
	Attendance Rate	**Chronically Absent**	**Math Score**	**ELA Score**
Transportation Eligibility	0.198	-0.014**	-0.004	0.010
	(0.121)	(0.005)	(0.010)	(0.012)
Distance	-0.577	0.043**	-0.008	-0.026
	(0.367)	(0.018)	(0.025)	(0.035)
Distance*Transport. Eligibility	0.433	-0.029	0.034	-0.014
	(0.489)	(0.023)	(0.037)	(0.048)
Constant	96.04***	0.057***	0.129***	0.113***
	(0.088)	(0.004)	(0.007)	(0.008)
Observations	92,566	92,566	52,133	51,913
Adj R Squared	0.020	0.018	0.667	0.578

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, economically disadvantaged status, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year.

Table 7: Heterogeneous Effects of Transportation Eligibility by Economically Disadvantaged Status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Attendance Rate		**Chronically Absent**		**Math Score**		**ELA Score**	
	Not Econ. Dis.	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**
Transportation Eligibility	0.006	0.630**	-0.003	-0.038***	-0.011	0.006	0.004	0.018
	(0.106)	(0.296)	(0.005)	(0.013)	(0.012)	(0.017)	(0.013)	(0.023)
Distance	-0.135	-1.594**	0.026*	0.097**	-0.012	0.011	-0.044	0.037
	(0.328)	(0.758)	(0.014)	(0.044)	(0.030)	(0.048)	(0.039)	(0.066)
Distance*Transport. Eligibility	0.189	1.015	-0.024	-0.069	0.065	-0.046	0.054	-0.183**
	(0.465)	(1.128)	(0.020)	(0.058)	(0.043)	(0.071)	(0.056)	(0.084)
Constant	96.36***	93.75***	0.043***	0.172***	0.146***	0.005	0.126***	-0.012
	(0.069)	(0.212)	(0.003)	(0.010)	(0.008)	(0.014)	(0.009)	(0.015)
Observations	63,100	29,466	63,100	29,466	35,669	16,464	35,603	16,310
Adj R Squared	0.003	0.011	0.003	0.007	0.656	0.616	0.543	0.571

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Samples are restricted to either economically disadvantaged (Econ. Dis.) or advantaged students. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year.

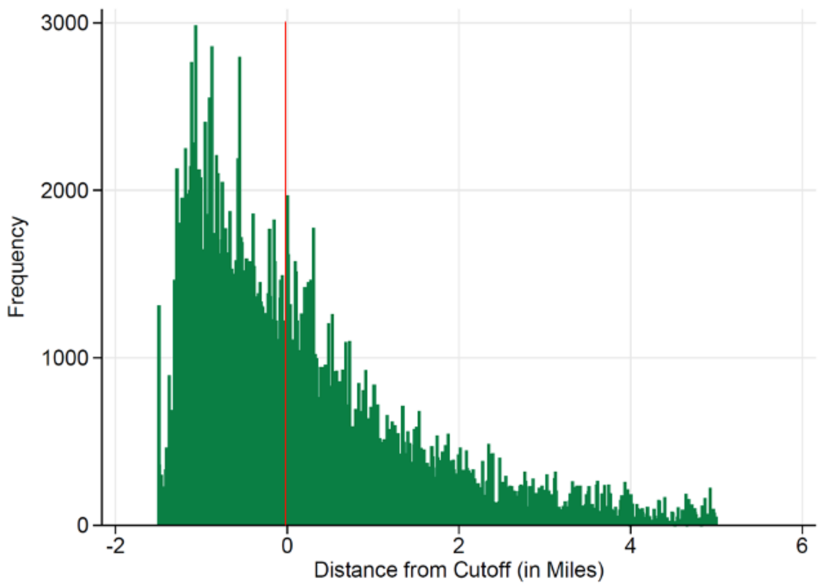
Table 8: Placebo Effects of Transportation Eligibility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Attendance Rate			Chronically Absent			Math Score			ELA Score		
	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.
Transportation Eligibility	-0.118	-0.074	-0.167	0.001	-0.006	0.013	-0.001	-0.007	0.002	-0.018	-0.013	-0.025
	(0.117)	(0.131)	(0.222)	(0.007)	(0.006)	(0.012)	(0.019)	(0.023)	(0.034)	(0.017)	(0.025)	(0.033)
Distance	0.244	-0.346	1.109	0.000	0.020	-0.020	0.028	0.017	0.089	0.027	0.006	0.097
	(0.422)	(0.405)	(0.753)	(0.021)	(0.016)	(0.046)	(0.057)	(0.078)	(0.088)	(0.071)	(0.090)	(0.111)
Distance*Transport. Elig.	-0.091	0.996	-1.768	0.013	0.005	-0.001	-0.072	-0.015	-0.195**	-0.038	-0.044	-0.088
	(0.724)	(0.754)	(1.209)	(0.035)	(0.032)	(0.072)	(0.066)	(0.105)	(0.099)	(0.087)	(0.117)	(0.147)
Constant	96.24***	96.42***	94.49***	0.048***	0.035***	0.138***	0.197***	0.238***	0.021	0.131***	0.168***	-0.028
	(0.090)	(0.096)	(0.175)	(0.005)	(0.004)	(0.009)	(0.015)	(0.019)	(0.023)	(0.018)	(0.023)	(0.025)
Observations	56,182	34,519	21,663	56,182	34,519	21,663	15,064	9,588	5,476	15,031	9,572	5,459
Adj R Squared	0.015	0.007	0.008	0.012	0.011	0.006	0.611	0.594	0.583	0.553	0.528	0.547

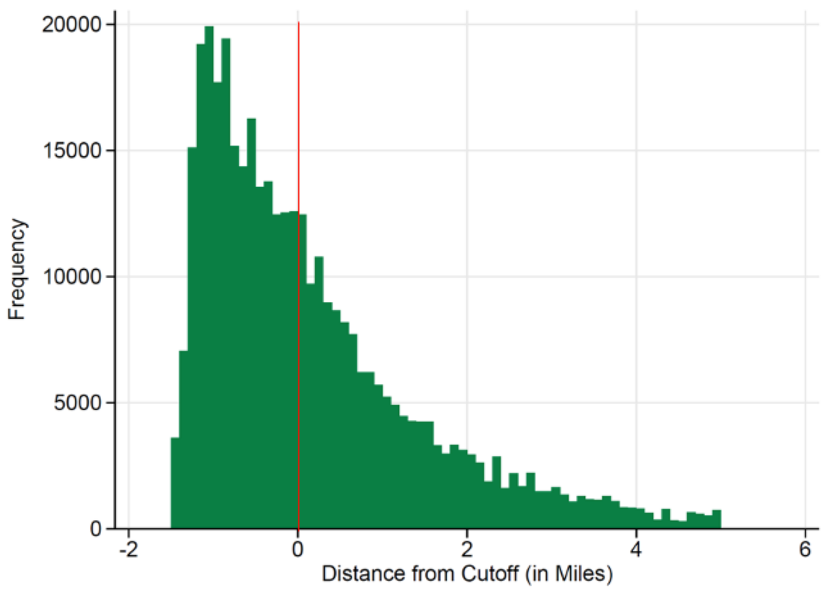
Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, economically disadvantaged (Econ. Dis.) status, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. The placebo sample includes student-year observations of elementary school students who attend their nearest school in their resident district, live in districts with a walking distance cutoff of 1.5 miles for middle school but not in elementary school, and live within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Students are transportation-eligible if students live farther than 1.5 miles walking distance from their nearest middle school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their nearest middle school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year.

Figure 1: Distribution of Observations

Panel A: 0.01 Mile Bin Size

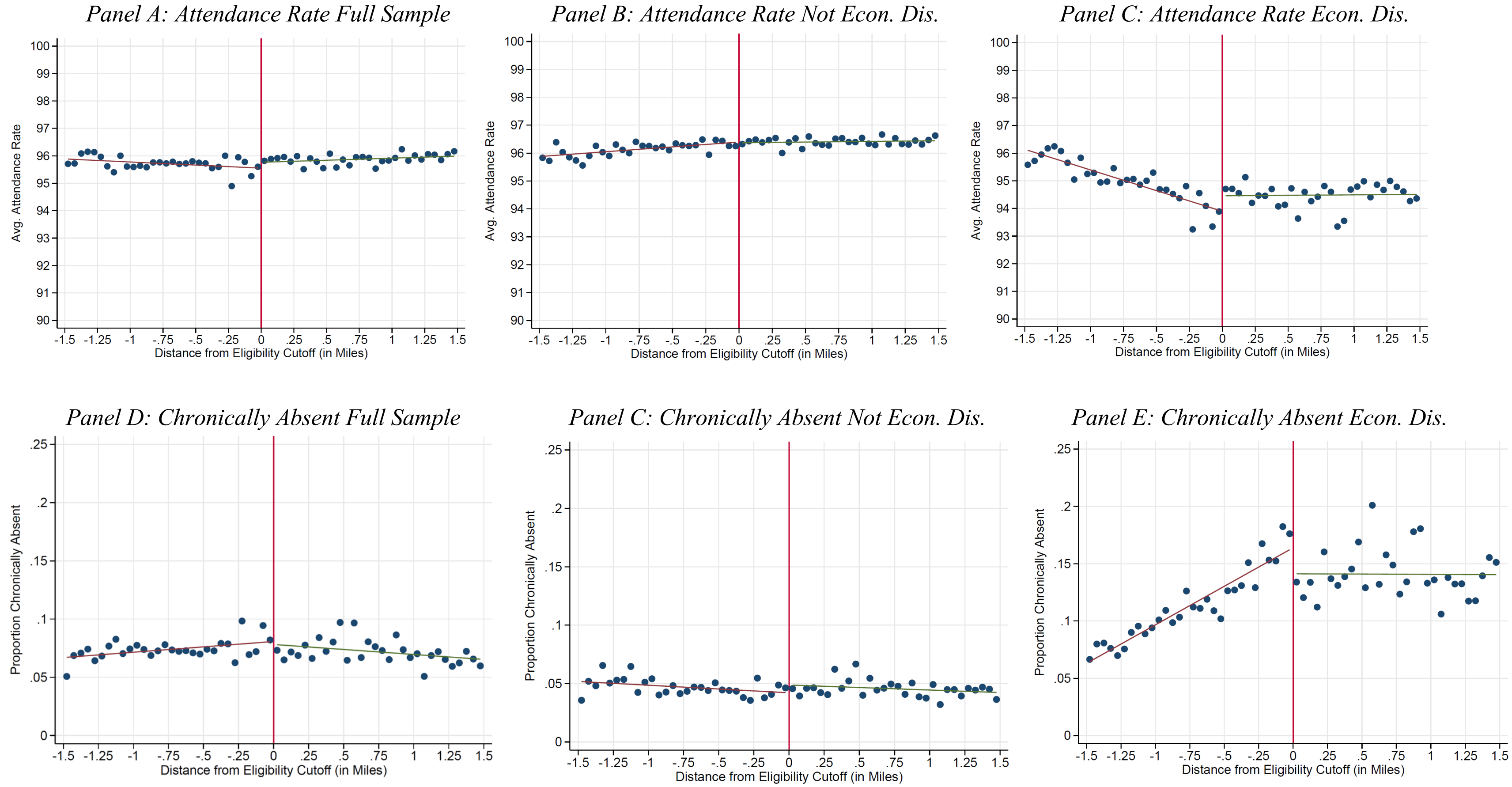


Panel B: 0.1 Mile Bin Size



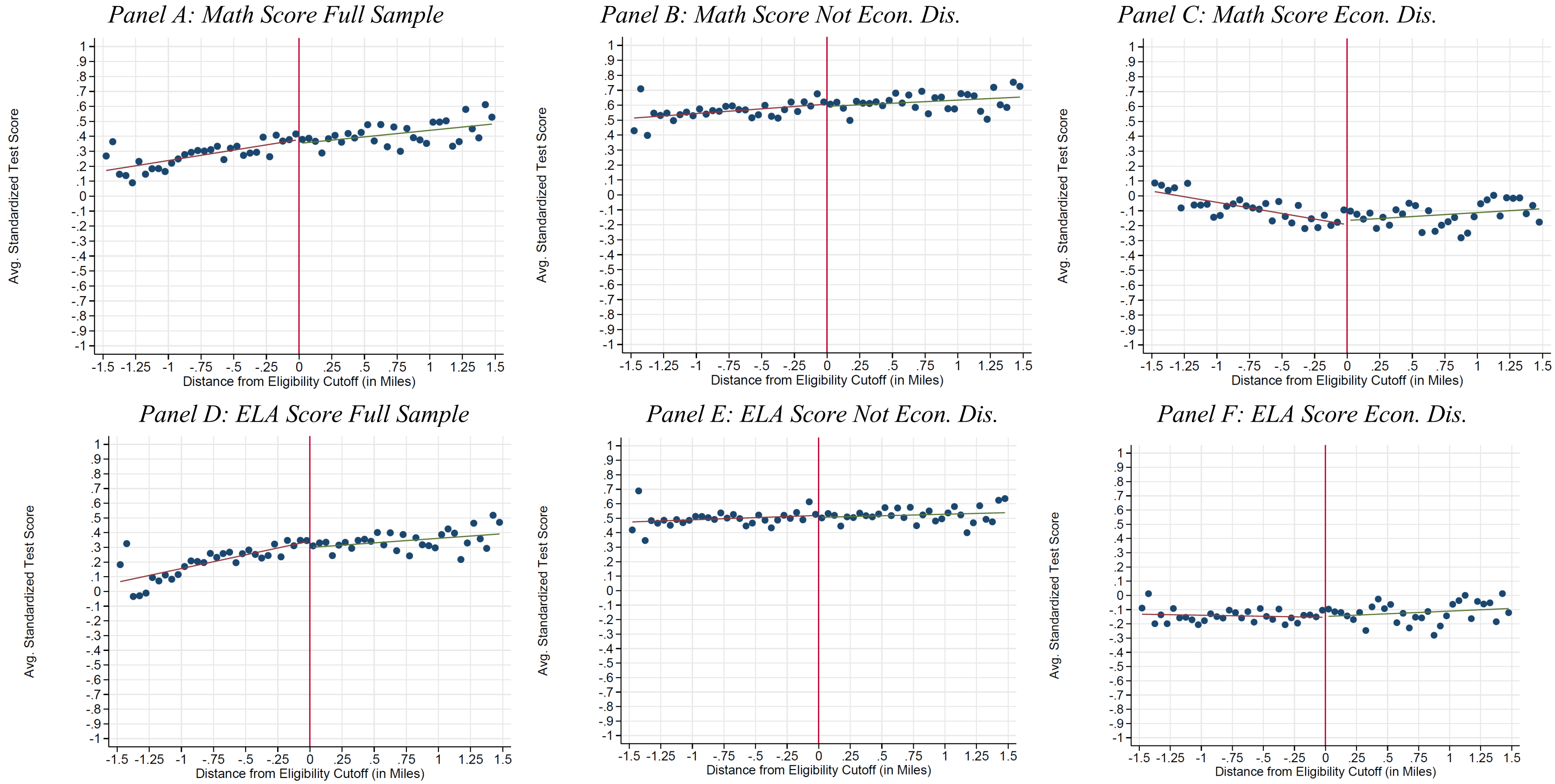
Note. Sample includes observations of students in the analytic sample living between zero and five miles from their attended school.

Figure 2: Unadjusted Average Attendance Rate and Proportion Chronically Absent by Distance from Threshold



Note. Each point represents the average outcome for all observations within a 0.05 mile bin width. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school assuming average traffic using Here API. The eligibility cutoff is 1.5 miles. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Figure 3: Unadjusted Average Standardized Math and ELA Test Scores by Distance from Threshold



Note. Each point represents the average outcome for all observations within a 0.05 mile bin width. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school assuming average traffic using Here API. The eligibility cutoff is 1.5 mile. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Appendix A: Tables and Figures

Table A1: Estimated Effects of Transportation Eligibility, Sample Excluding Students Likely Affected by Measurement Error

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Attendance Rate			Chronically Absent			Math Score			ELA Score		
	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.
Transportation Eligibility	0.112	-0.207	0.515	-0.021*	-0.004	-0.046*	-0.001	-0.012	0.015	-0.006	-0.003	-0.009
	(0.214)	(0.181)	(0.455)	(0.011)	(0.008)	(0.026)	(0.015)	(0.017)	(0.029)	(0.020)	(0.025)	(0.028)
Distance	-0.065	0.598	-1.186	0.047	0.021	0.110	0.004	0.013	0.014	-0.028	-0.075	0.081
	(0.578)	(0.442)	(1.381)	(0.030)	(0.019)	(0.079)	(0.035)	(0.040)	(0.074)	(0.049)	(0.063)	(0.087)
Distance*Transport. Elig.	-0.436	-0.667	0.463	-0.007	-0.004	-0.057	-0.013	0.016	-0.114	0.042	0.131	-0.180
	(0.795)	(0.772)	(1.969)	(0.036)	(0.032)	(0.097)	(0.051)	(0.057)	(0.092)	(0.069)	(0.086)	(0.120)
Constant	96.13***	96.56***	93.81***	0.061***	0.043***	0.177***	0.128***	0.149***	0.009	0.108***	0.112***	0.003
	(0.148)	(0.114)	(0.377)	(0.008)	(0.005)	(0.022)	(0.011)	(0.012)	(0.022)	(0.013)	(0.016)	(0.022)
Observations	65,855	43,540	22,315	65,855	43,540	22,315	37,657	25,130	12,527	37,481	25,082	12,399
Adj R Squared	0.019	0.002	0.011	0.017	0.002	0.007	0.665	0.657	0.614	0.580	0.547	0.571

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, economically disadvantaged (Econ. Dis.) status, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Given the possible measurement error of using census block centroids as students' addresses, the sample only includes student-year observations of students living in census blocks where the distance from the population weighted centroid of the census block to the walking distance cutoff is farther than to the centroid of the nearest census block. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year.

Table A2: Estimated Coefficients of Transportation Eligibility for Balance Tests, All Bandwidths and Splines

OUTCOMES	(1) Female	(2) White	(3) Black	(4) Hispanic	(5) Asian	(6) Other Race	(7) Econ. Dis.	(8) EL
Linear Spline								
0.5 Mile Bandwidth	0.001	0.024	-0.012	-0.008	0.003	-0.007	-0.012	0.001
	(0.009)	(0.015)	(0.008)	(0.007)	(0.007)	(0.005)	(0.015)	(0.009)
0.4 Mile Bandwidth	-0.005	0.016	-0.004	-0.007	0.002	-0.007	-0.000	0.000
	(0.011)	(0.017)	(0.010)	(0.008)	(0.009)	(0.005)	(0.017)	(0.011)
0.3 Mile Bandwidth	0.008	0.020	-0.009	-0.017*	0.007	-0.002	-0.024	0.000
	(0.011)	(0.020)	(0.011)	(0.009)	(0.012)	(0.006)	(0.020)	(0.011)
0.25 Mile Bandwidth	0.003	0.027	-0.012	-0.015	0.006	-0.006	-0.026	0.002
	(0.014)	(0.021)	(0.012)	(0.009)	(0.013)	(0.007)	(0.021)	(0.012)
0.2 Mile Bandwidth	-0.008	0.032	-0.013	-0.008	0.000	-0.012	-0.034	0.002
	(0.017)	(0.023)	(0.013)	(0.011)	(0.014)	(0.008)	(0.021)	(0.013)
0.15 Mile Bandwidth	-0.016	0.024	-0.019	0.006	0.001	-0.011	-0.006	0.011
	(0.021)	(0.028)	(0.014)	(0.015)	(0.016)	(0.009)	(0.025)	(0.015)
Quadratic Spline								
0.5 Mile Bandwidth	0.002	0.021	-0.006	-0.011	0.001	-0.005	-0.011	-0.003
	(0.014)	(0.023)	(0.012)	(0.009)	(0.014)	(0.007)	(0.022)	(0.015)
0.4 Mile Bandwidth	0.008	0.032	-0.018	-0.014	0.004	-0.005	-0.035	0.000
	(0.016)	(0.025)	(0.014)	(0.010)	(0.015)	(0.008)	(0.026)	(0.014)
0.3 Mile Bandwidth	-0.016	0.031	-0.014	0.003	-0.008	-0.012	-0.018	0.007
	(0.021)	(0.026)	(0.015)	(0.012)	(0.015)	(0.010)	(0.026)	(0.014)
0.25 Mile Bandwidth	-0.014	0.050*	-0.022	0.006	-0.019	-0.016	-0.026	0.002
	(0.022)	(0.028)	(0.016)	(0.014)	(0.017)	(0.011)	(0.029)	(0.015)
0.2 Mile Bandwidth	-0.018	0.028	-0.017	0.018	-0.012	-0.017	0.012	0.014
	(0.026)	(0.031)	(0.018)	(0.015)	(0.017)	(0.012)	(0.031)	(0.018)
0.15 Mile Bandwidth	-0.016	0.048	-0.014	0.008	-0.009	-0.034**	0.028	0.027
	(0.035)	(0.037)	(0.022)	(0.016)	(0.020)	(0.015)	(0.040)	(0.022)

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include walking distance to school, its interaction with transportation eligibility, and school-by-grade-by-year fixed effects. Standard errors are clustered at the school level. In the models with a quadratic spline, I also include a quadratic term of walking distance and its interaction with transportation eligibility. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Econ. Dis. and EL are abbreviations for economically disadvantaged and English Learner respectively. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Table A3: Estimated Coefficients of Transportation Eligibility, All Bandwidths and Splines

	(1)	(2)	(3)	(4)
	Attendance Rate	**Chronically Absent**	**Math Score**	**ELA Score**
Linear Spline				
0.5 Mile Bandwidth	0.179*	-0.014***	-0.005	0.007
	(0.109)	(0.005)	(0.009)	(0.009)
0.4 Mile Bandwidth	0.198	-0.014**	-0.004	0.010
	(0.121)	(0.005)	(0.010)	(0.012)
0.3 Mile Bandwidth	0.302**	-0.015**	0.016	0.019
	(0.144)	(0.007)	(0.011)	(0.013)
0.25 Mile Bandwidth	0.283*	-0.011	-0.002	0.023
	(0.161)	(0.008)	(0.012)	(0.014)
0.2 Mile Bandwidth	0.361*	-0.013	-0.005	0.025*
	(0.204)	(0.010)	(0.014)	(0.015)
0.15 Mile Bandwidth	0.353	-0.016	-0.009	0.032
	(0.236)	(0.012)	(0.018)	(0.021)
Quadratic Spline				
0.5 Mile Bandwidth	0.300*	-0.015**	-0.001	0.019
	(0.164)	(0.007)	(0.012)	(0.015)
0.4 Mile Bandwidth	0.362*	-0.016*	-0.005	0.020
	(0.187)	(0.009)	(0.014)	(0.016)
0.3 Mile Bandwidth	0.348	-0.014	-0.013	0.019
	(0.225)	(0.012)	(0.017)	(0.018)
0.25 Mile Bandwidth	0.446*	-0.019	-0.010	0.024
	(0.260)	(0.013)	(0.019)	(0.021)
0.2 Mile Bandwidth	0.313	-0.015	-0.020	0.014
	(0.278)	(0.014)	(0.023)	(0.024)
0.15 Mile Bandwidth	0.497	-0.022	-0.027	-0.014
	(0.318)	(0.017)	(0.028)	(0.028)

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include walking distance to school, its interaction with transportation eligibility, student race, gender, economically disadvantaged status, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. In the models with a quadratic spline, I also include a quadratic term of walking distance and its interaction with transportation eligibility. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year.

Table A4: Heterogeneous Effects by Economically Disadvantaged Status, All Bandwidths and Splines

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Attendance Rate		**Chronically Absent**		**Math Score**		**ELA Score**	
	Not Econ. Dis.	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**	**Not Econ. Dis.**	**Econ. Dis.**
Linear Spline								
0.5 Mile Bandwidth	-0.002	0.562**	-0.003	-0.035***	-0.007	-0.004	0.005	0.006
	(0.091)	(0.267)	(0.005)	(0.012)	(0.011)	(0.016)	(0.011)	(0.019)
0.4 Mile Bandwidth	0.006	0.630**	-0.003	-0.038***	-0.011	0.006	0.004	0.018
	(0.106)	(0.296)	(0.005)	(0.013)	(0.012)	(0.017)	(0.013)	(0.023)
0.3 Mile Bandwidth	0.091	0.763*	-0.004	-0.034*	-0.007	0.020	0.009	0.045
	(0.120)	(0.393)	(0.006)	(0.018)	(0.014)	(0.021)	(0.015)	(0.028)
0.25 Mile Bandwidth	0.093	0.716*	-0.002	-0.031	-0.012	0.020	0.015	0.037
	(0.133)	(0.424)	(0.007)	(0.020)	(0.014)	(0.024)	(0.015)	(0.033)
0.2 Mile Bandwidth	0.231	0.876	-0.007	-0.034	-0.007	0.006	0.016	0.039
	(0.153)	(0.589)	(0.008)	(0.028)	(0.016)	(0.028)	(0.018)	(0.038)
0.15 Mile Bandwidth	0.283	0.821	-0.010	-0.041	0.003	-0.024	0.026	0.037
	(0.173)	(0.724)	(0.009)	(0.034)	(0.022)	(0.035)	(0.025)	(0.044)
Quadratic Spline								
0.5 Mile Bandwidth	0.101	0.864**	-0.004	-0.041**	-0.010	0.012	0.010	0.037
	(0.142)	(0.391)	(0.007)	(0.019)	(0.015)	(0.022)	(0.017)	(0.033)
0.4 Mile Bandwidth	0.186	0.821*	-0.006	-0.037	-0.008	-0.004	0.007	0.050
	(0.152)	(0.470)	(0.008)	(0.024)	(0.015)	(0.025)	(0.017)	(0.037)
0.3 Mile Bandwidth	0.170	0.903	-0.004	-0.039	-0.013	-0.019	0.008	0.047
	(0.171)	(0.616)	(0.009)	(0.032)	(0.018)	(0.033)	(0.020)	(0.038)
0.25 Mile Bandwidth	0.291	1.053	-0.010	-0.044	0.004	-0.031	0.011	0.060
	(0.187)	(0.750)	(0.009)	(0.037)	(0.022)	(0.036)	(0.026)	(0.043)
0.2 Mile Bandwidth	0.192	0.914	-0.007	-0.045	0.002	-0.047	0.001	0.032
	(0.219)	(0.779)	(0.011)	(0.042)	(0.026)	(0.048)	(0.027)	(0.050)
0.15 Mile Bandwidth	0.430*	0.964	-0.015	-0.044	-0.013	-0.024	-0.035	-0.005
	(0.254)	(1.004)	(0.012)	(0.057)	(0.029)	(0.073)	(0.032)	(0.067)

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. In the models with a quadratic spline, I also include a quadratic term of walking distance and its interaction with transportation eligibility. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Table A5: Estimated Effects of Transportation Eligibility, Non-Parametric Approach

	(1)	(2)	(3)	(4)	(5)	(6)
	Attendance Rate			**Chronically Absent**		
	Full Sample	**Not Econ. Dis.**	**Econ. Dis.**	**Full Sample**	**Not Econ. Dis.**	**Econ. Dis.**
Conventional Estimate	0.433***	0.097	1.043***	-0.020***	-0.005	-0.050***
	(0.161)	(0.102)	(0.368)	(0.006)	(0.005)	(0.013)
Robust and Bias-Corrected Estimate	0.426**	0.115	1.038***	-0.021***	-0.006	-0.055***
	(0.167)	(0.120)	(0.370)	(0.007)	(0.006)	(0.015)
N	380,101	238,010	142,091	380,101	238,010	142,091
Effective N	103,213	97,173	35,803	113,878	67,699	37,986
Bandwidth for Estimate	0.449	0.625	0.485	0.495	0.431	0.515
Bandwidth for Bias Correction	0.621	0.954	0.677	0.765	0.717	0.882

Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include student race, gender, economically disadvantaged status, and English Learner covariates and district, grade, and year fixed effects. Standard errors are clustered at the school level. Bandwidths are in miles. Optimal bandwidths and bias-corrected and robust estimates are calculated using the procedures proposed by Calonico, Cattaneo, and Titiunik (2014) and Calonico, Cattaneo, and Farrell (2020). Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

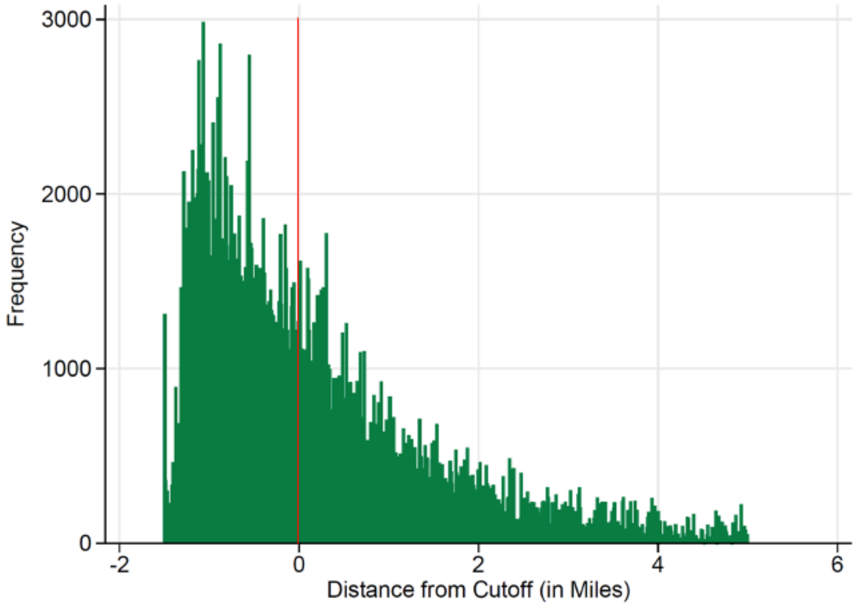
Table A6: Estimated Effects of Transportation Eligibility, Donut Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Attendance Rate			Chronically Absent			Math Score			ELA Score		
	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.	Full Sample	Not Econ. Dis.	Econ. Dis.
0.01 Mile Exclusion												
Transport. Eligibility	0.153	-0.040	0.608**	-0.011**	-0.002	-0.036***	-0.007	-0.013	0.002	0.009	0.005	0.014
	(0.126)	(0.107)	(0.292)	(0.006)	(0.005)	(0.013)	(0.010)	(0.012)	(0.018)	(0.012)	(0.013)	(0.022)
Observations	89,837	61,231	28,606	89,837	61,231	28,606	50,671	34,690	15,981	50,459	34,629	15,830
0.05 Mile Exclusion												
Transport. Eligibility	0.146	-0.070	0.451	-0.014*	-0.003	-0.034*	-0.002	-0.019	0.026	0.002	-0.007	0.018
	(0.165)	(0.137)	(0.362)	(0.008)	(0.006)	(0.018)	(0.012)	(0.013)	(0.023)	(0.015)	(0.017)	(0.026)
Observations	80,665	54,702	25,963	80,665	54,702	25,963	45,423	31,028	14,395	45,232	30,973	14,259
0.1 Mile Exclusion												
Transport. Eligibility	0.016	-0.178	0.258	-0.008	0.002	-0.028	0.004	-0.012	0.034	-0.014	-0.005	-0.052
	(0.200)	(0.182)	(0.446)	(0.011)	(0.010)	(0.025)	(0.017)	(0.020)	(0.033)	(0.022)	(0.025)	(0.036)
Observations	68,223	46,371	21,852	68,223	46,371	21,852	38,256	26,221	12,035	38,096	26,169	11,927

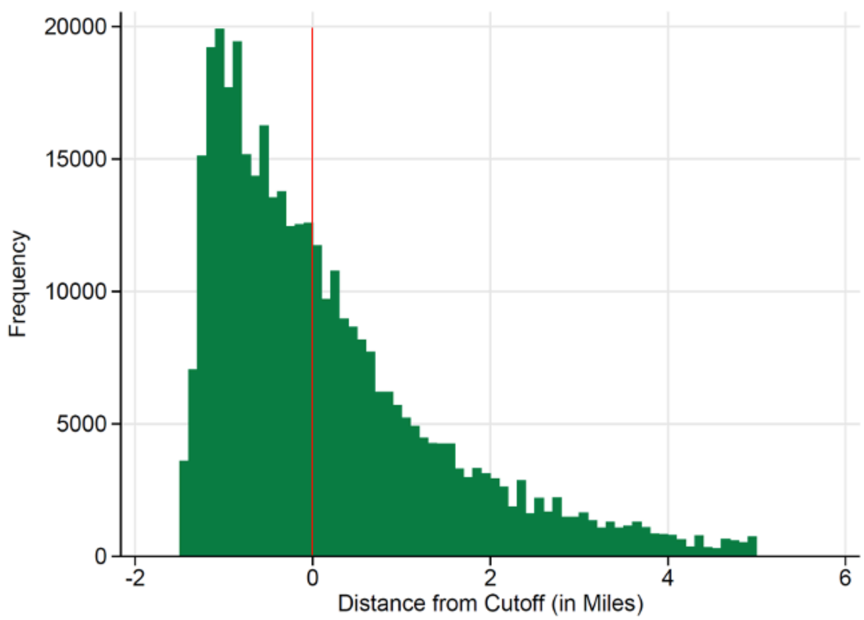
Note. Standard errors in parentheses. *p<0.1, ** p<0.05, ***p<0.01. Models include walking distance to school, its interaction with transportation eligibility, student race, gender, economically disadvantaged status, and English Learner covariates and school-by-grade-by-year fixed effects. The models that estimate achievement outcomes also include a lagged test score as a covariate. Standard errors are clustered at the school level. The sample includes student-year observations living within 0.4 miles of the transportation eligibility cutoff, my preferred bandwidth. Observations that are within either 0.01, 0.05, or 0.1 miles are excluded. Students are transportation-eligible if students live farther than 1.5 miles walking distance from school. Walking distances are calculated from the population weighted centroid of the student's resident census block to their school's address assuming average traffic using Here API. Students are considered chronically absent if they miss more than ten percent of possible days in the school year. Math and English Language Arts (ELA) test scores on the Michigan Educational Assessment Program, MEAP, or the Michigan Student Test of Educational Progress, M-STEP are standardized within grade, subject, and year. Econ. Dis. is an abbreviation for economically disadvantaged. In Michigan, students are considered economically disadvantaged if they qualify for free or reduced lunch, receive food (SNAP) or cash assistance (TANF), or they are homeless, migrant, or in foster care.

Figure A1: Distribution of Observations without Mobile Home Park Census Block

Panel A: 0.01 Mile Bin Size



Panel B: 0.
1 Mile Bin Size



Note. Sample includes observations of students in the analytic sample living between zero and five miles from their attended school excluding the census block containing Independence Woods Mobile Home Park.