Off to School:

Do the school choice laws affect the students' travel mode?

Abstract

My interest in travel behavior led me to look into how children travel. The primary daily non-discretionary destination for children is the school. The first question was what the main determining factor for students is, to choose this destination. This brought me to the school choice policies of different cities. I thought it would be interesting to look at how these different policy decisions in different cities shape travel for students. I put these different travel modes into two categories: active and non-active. The active transportation category includes any self-propelled, human-powered mode of transportation such as walking or biking. The non-active transportation category includes the other modes such as driving, taking public, or a school bus. This study involves analyzing the data from National Household Travel Survey (2017) which includes comprehensive personal and household travel data for daily, non-commercial travel by all modes concerning different geographies and demographics. Within the analysis, I only look at students who are 16 or under and reside in Austin, TX, and Denver, CO. These two cities have similar demographics but different policies regarding school choice—with Austin having the stricter laws. For this study, I do not consider parameters like urban form, education funding, bikeability, and walkability, or other physical elements that could affect travel behavior. The variables I control for are the city, number of drivers in the household, household income, household vehicle count, sex, race, age, Hispanic status, urban-rural living, travel time, and distance to school.

I hypothesize that I would find that having more flexibility with school choice (Denver) means that students will tend to use active transportation modes for the long travel distances to the school locations. This study will be helpful to understand how the varying socioeconomic and demographic conditions influence travel to school which can inform policymaking.

Introduction

States all around the country have different policies related to school choice. On the one hand, Colorado, which is a state that has one of the most relaxed school choice policies around the country, allows the students to attend any public or private school regardless of any administrative boundary during the open enrollment period every year. On the other hand, states like Texas have much stricter rules around this. In Texas, the policy is that a student can transfer to another district if the receiving district approves the particular case. Districts can also enter into transfer agreements among themselves (Olneck-Brown, n.d.).

School choice comes with various barriers, one of the most important one being transportation. In choice-rich cities, distance to school and availability of transportation are two substantial driving factors in choosing a school (Blagg, 2020). Some districts and schools offer none or limited means of transportation to students who prefer to attend a school that is outside of their district or neighborhood. This means that the preferred location of the school is a function of the household resources. One survey conducted by The Centre on Reinventing Public Education presents that 29 percent of the parents in Denver report that they have difficulty finding appropriate transportation to send their child to the school of their choosing. The same survey also states that 64 percent of the parents in Denver drive their child to school and 50 percent of the parents choose a school outside of their neighborhood (Jochim, et.al, 2014). This shows that with the lack of reliable transportation, school choice becomes a limited opportunity for some families. This creates unfair situations such as students having to attend a school that is in proximity to their residences since they do not have the means to travel out of their district or neighborhood. With this, I speculate that disadvantaged students prefer active transportation modes such as walking and biking more than their peers with means or travel further in non-auto modes (excluding walking and biking) to school.

So, my question is: Are relaxed school choice policies creating disparities for travel mode to school and increasing active travel mode uses among disadvantaged students? Or are those students having to choose active travel modes to school regardless of these policies? I think it is interesting to study this comparatively to examine the travel consequences of different education policies. For this reason, I decided to choose and examine two cities that have different levels of the strictness of school choice laws but are demographically similar to each other. The following data is from Census. Denver, CO with a population of 727,211 in 2019, consisted of 54 percent White-alone and 30 percent Hispanic or Latino population. In addition, 19.8 percent of the population was under the age of 18. In Austin, TX, the population in 2019 was 978,908 and 48 percent of the total was white-alone, with 34 percent being Hispanic or Latino and under the age of 18 population was 20.4 percent. Looking at these demographic figures and the varying approaches in the school choice policies, I think it would be beneficial to study these two cities comparatively.

In order to comprehensively analyze, I will use the Denver and Austin-based trip-level data from the National Household Travel Survey dataset from the year 2017. The analysis will look at students' who are under the age of 16 (because of the age of being able to obtain a driver's license) travel mode choices for school trips. My outcome variable is the choice between active or non-active travel mode, and I rely on the following explanatory variables: the city (Austin versus Denver), number of drivers in the household, household income, household vehicle count, sex, race, age, Hispanic status, urban-rural living, travel time, and distance to school.

Methodology

I collected all response data for Austin and Denver from National Household Travel Survey (2017) in basic Excel table format. I filtered the data to narrow it down to survey responders who are 16 and under. Next, I applied another filter to make sure that my data frame only included the trips that are to or from school. This was followed by recoding certain variables and preparing them for the tests and analysis (Table 1).

Table 1: Outcome and Explanatory Variables

	Variable	**Explanation and recoding**
Outcome Variable	active_nactive	*Active (Walk or Bike) =1 or Non-active=0*
Explanatory Variables	City	*Austin, Denver*
	drvrcnt	*Number of drivers in the household*
	hhfaminc	*Household Income* *0= $70,000 and under, 1= greater than $70,000*
	hhvehcnt	*Count of household vehicles*
	hispanic	*Hispanic status* *Yes=1, No=0*
	race	*White=1, Non-white=0*
	r_age	*Age*
	sex	*Male=1, Female=0*
	trvlcmin	*Trip duration in minutes*
	urban_rural	*Urban=1, Rural=0*
	disttosc17	*Road network distance, in miles, between respondent's home location and school location*

One notable thing I want to point out is that the categorization of the household income was based on the yearly median household income which is around $70,000 in both cities.

For the analysis, I utilized R to conduct several tests. Firstly, I calculated the summary statistics to have a better comprehension of the dataset I am working with. Secondly, I conduct a Chi-Square test to see if there is a relationship between household income and active transportation mode use. This was followed by running a logit regression test to study the probability of using active/non-active travel modes.

Analysis & Results

First, I present the summary statistics for the two cities to better understand the composition of the data.

Table 2: Summary of the data for Austin

	Austin, TX (1730 Obs-87%)						
	Variable	**Obs.**	**Mean**	**Prop.**	**Std. Dev.**	**Min**	**Max**
Outcome Variable	*Active (Walk or Bike) =1 or non-active=0*	Active= 201 Non-active=1529		Active= 12% Non-active=88%			
Explanatory Variables	*Number of drivers in the household*	1730	2.1		0.8	1	6
	Household Income 0= $70,000 and under 1= greater than $70,000	0=520 1=1210		0=30% 1=70%			
	Count of household vehicles	1730	2.2		0.84	0	7
	Hispanic status Yes=1, No=0	Yes=220 No=1510		Yes=13% No=87%			
	White=1, Non-white=0	Yes=385 No=1345		Yes=22% No=78%			
	Age (years)	1730	10.5		3.3	5	16
	Male=1, Female=0	Male=826 Female=904		Male=48% Female=52%			
	Trip duration in minutes	1730	19.2		19.5	1	258
	Urban=1, Rural=0	Urban=1516 Rural=214		Urban=88% Rural=12%			
	Road network distance, in miles, between respondent's home location and school location	1730	5.2		13.2	0.02	190.2

Table 3: Summary of the data for Denver

	Denver, CO (261 Obs-13%)						
	Variable	**Obs.**	**Mean**	**Prop.**	**Std. Dev.**	**Min**	**Max**
Outcome Variable	*Active (Walk or Bike) =1 or non-active=0*	Active= 30 Non-active=231		Active= 11% Non-active=89%			
Explanatory Variables	*Number of drivers in the household*	261	2.2		0.48	1	4
	Household Income 0= $70,000 and under 1= greater than $70,000	0=51 1=210		0=20% 1=80%			
	Count of household vehicles	261	2.8		1.05	1	6
	Hispanic status Yes=1, No=0	Yes=11 No=250		Yes=4% No=96%			
	White=1, Non-white=0	Yes=33 No=228		Yes=13% No=87%			
	Age (Years)	261	9.9		3.4	5	16
	Male=1, Female=0	Male=137 Female=124		Male=52% Female=48%			
	Household vehicle used on trip Yes=1, No=2	Yes=183 No=68		Yes=73% No=27%			
	Trip duration in minutes	261	21.7		31.8	1	320
	Urban=1, Rural=0	Urban=214 Rural=47		Urban=82% Rural=18%			
	Road network distance, in miles, between respondent's home location and school location	261	4.35		5.8	0.23	37.4

To figure out if there is a relationship between a significant variable that is household income and my outcome variable active/non-active travel modes I run a Chi-Square test. To begin with, I create a table (Table 4) and a bar chart (Figure 1) to illustrate the preliminary relationship.

Table 4: Mode and income observations for the full sample

	Household income $70,000 and under =0	**Household income greater than $70,000 =1**
Non-active mode=0	237	1552
Active mode=1	30	172

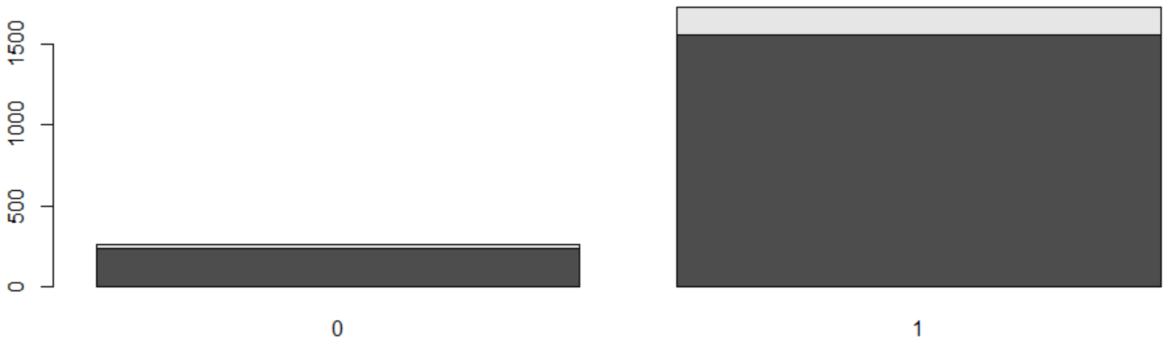

Figure 1: Distribution of mode concerning household income

These results show that the survey included more responders from people with higher income levels which could be interpreted as a flaw in the data collection. Keeping this in mind, I run a Chi-Square test. For the Chi-square test, the null hypothesis is that there is no relationship between household income and active or non-active travel mode to school. The results of this test show that the relation between these two variables was not significant, X2(1, N=1991) =0,27538, p=0.5995>0.05. The analysis done by using National Household Travel Survey (2017) dataset shows that household income is not related to students' active or non-active travel mode to school.

These results raise some questions. My initial intuition suggested that there would be a relationship between household income and active or non-active travel mode. This leads me to the regression analysis to figure out how the other explanatory variables perform. With the regression analysis, I want to know what factors are associated with moving a student from a non-active transportation mode to an active transportation mode and the probability of this move. My outcome variable is active_nactive where the active transportation mode is 1, non-active transportation mode is 0. Table 5 presents the regression results. Please refer to Appendix A and Appendix B for individual regression and probability results for Austin and Denver, respectively.

Table 5: Regression results and effect size for Austin and Denver combined

	Regression	Odds ratio	Effect size (%)
	Dependent Variable active=1, non-active=0	*Dependent Variable* active=1, non-active=0	*Dependent Variable* active=1, non-active=0
as.factor(City)Denver	0.627** (0.297)	1.872** (0.297)	87.2
drvrcnt	-0.099 (0.192)	0.905 (0.192)	-
as.factor(hh_income_bin)1	-0.290 (0.305)	0.748 (0.305)	-
hhvehcnt	-0.422*** (0.146)	0.656*** (0.146)	34.4
as.factor(male)1	1.140*** (0.206)	3.125*** (0.206)	212.5
as.factor(white)1	0.699*** (0.264)	2.012*** (0.264)	101.2
r_age	0.215*** (0.036)	1.240*** (0.036)	24
as.factor(Hispanic)1	0.305 (0.421)	0.737 (0.421)	-
as.factor(urban)1	0.932 (0.786)	2.540 (0.786)	-
trvlcmin	0.007 (0.005)	1.007 (0.005)	-
disttosc17	-2.020*** (0.168)	0.133*** (0.168)	86.7
Constant	-2.087** (0.951)	0.124** (0.951)	-
Observations: 1,809 Log-Likelihood: 361.579 Akaike Inf. Crit: 747.158			
Note: *p<0.1; **p<0.05; ***p<0.01			

The regression results are interesting. There are 6 total significant explanatory variables at different levels of significance. The most notable result is that the students in Denver are 87.2 percent more likely to use active travel modes to school. This is particularly noteworthy since the school choice laws are more relaxed in Denver compared to Austin. I speculate that there could be two main reasons for this. The first one is that the neighborhood schools which are easily accessible by foot or bike, sustain enough satisfaction to most parents, so they do not prefer sending their child to a school that is further away which would require a non-active travel mode such as driving, public transportation, or school bus. The second reason could be that Denver does not provide sufficient transportation to schools that are out of the immediate neighborhood or district. A supporting argument for this comes from a report written by Urban Institute Student Transportation Working Group. The report states that "*Denver Public Schools provide transportation only for students who live a considerable distance from their neighborhood school. For example, students in Denver middle schools are eligible for yellow bus transportation if they live more than 2.5 miles (walking distance) from their school, a distance that is farther than high schoolers are required to live to access a transit benefit in the four other cities*" (Blagg, 2020). This is staggering since Denver Public School administrators think that a middle schooler should be able to walk 80 minutes a day to and from school. This number is much higher for high schoolers. This shows how the lack of appropriate transportation can hinder the right of school choice provided by the city itself. Austin Independent School District, which includes 74,000 students from 125 schools, provides school bus service to students who live 2 miles from their school campus (Transportation policy, n.d.).

The next significant variable for both cities is household vehicle count. The results show that with each car added to the household resources, the likelihood of walking or biking to school decreases by 34.4%. Another notable result is that male students are 212.5 percent more likely to use active travel modes to school. I speculate that female students do not feel as safe or comfortable as their male counterparts when they walk or bike to school in either city. The other significant variable is race. It seems like white students are 101.2 percent more likely to walk or bike to school compared to non-white students. I speculate that the schools in predominantly white neighborhoods are more satisfactory to the parents and further funded. That is why they do not prefer another school outside of their immediate area while some predominantly non-white schools struggle to stay open in Denver (Asmar, 2019).

The next important variable that is found to be significant is age. The results present that with each year of age added, the probability of choosing an active travel mode to school increases by 24 percent. The obvious explanation is that parents might not feel comfortable with their younger children walking or biking to school. The last significant variable is the distance to school. With each mile added to the distance between the residence of the student and their school, the probability of walking or biking to school decreases by 86.7 percent. This seems only natural.

Conclusion

Considering all the results and speculations above I believe that this study sheds light on where the school choice policies lack primarily which seems to be inadequate transportation for children. Providing the freedom of being able to attend any school is not enough. The cities and states need to develop comprehensive policies to address the issues of access to schools in a fair and just manner. These new policies should not put a burden on the household's resources. I believe that with the appropriate transportation infrastructure, the quality of education and success in schools citywide will increase.

All that said there are some limitations of this study. The first limitation of my study was the difference in sample sizes from two cities where Austin had almost 6.5 times more observations than Denver. It would be great to repeat the same study with comparable sizes of observations. Another limitation is that this study did not take urban form, citywide transportation approaches, or funding for schools into account. I speculate that they would have affected the results significantly.

Appendices

Appendix A – Regression Results for Austin, TX

	Regression	Odds ratio	Effect size (%)
	Dependent Variable active_nactive	*Dependent Variable* active_nactive	*Dependent Variable* active_nactive
drvrcnt	-0.145 (0.205)	0.865 (0.205)	-
as.factor(hh_income_bin)1	-0.674* (0.354)	0.510* (0.354)	49
hhvehcnt	-0.096 (0.138)	0.909 (0.138)	-
as.factor(sex)1	1.286*** (0.227)	3.619*** (0.227)	261.9
as.factor(race)1	0.531* (0.287)	1.700* (0.287)	70
r_age	0.177*** (0.040)	1.194*** (0.040)	19.4
as.factor(hispanic)1	-0.358 (0.432)	0.699 (0.432)	-
as.factor(urban_rural)1	0.833 (0.807)	2.299 (0.807)	-
trvlcmin	0.003 (0.005)	1.003 (0.005)	-
disttosc17	-2.236*** (0.203)	0.107*** (0.203)	89.3
Constant	-1.523 (0.987)	0.218 (0.987)	-
Observations: 1,574 Log-Likelihood: -301.191 Akaike Inf. Crit: 624.382			
Note: *p<0.1; **p<0.05; ***p<0.01			

Appendix B - Regression Results for Denver, CO

	Regression	Odds ratio	Effect size (%)
	Dependent Variable active_nactive	*Dependent Variable* active_nactive	*Dependent Variable* active_nactive
drvrcnt	0.769 (1.176)	2.157 (1.176)	-
as.factor(hh_income_bin)1	2.786** (1.154)	16.221** (1.154)	1,522
hhvehcnt	-4.051*** (1.031)	0.017*** (1.031)	98.3
as.factor(sex)1	1.752** (0.844)	5.768** (0.844)	576.7
as.factor(race)1	3.234* (1.765)	25.372* (1.765)	2,437
r_age	0.466*** (0.155)	1.593*** (0.155)	59.3
as.factor(hispanic)1	-7.509 (5,661.924)	0.001 (5,661.924)	-
as.factor(urban_rural)1	15.872 (1,770.121)	7,822,262.000 (1,770.121)	-
trvlcmin	0.057* (0.033)	1.058* (0.033)	5.8
disttosc17	-3.272*** (0.964)	0.038*** (0.964)	96.2
Constant	-16.351 (1,770.123)	0.00000 (1,770.123	-
Observations: 235 Log-Likelihood: 31.348 Akaike Inf. Crit: 84.696			
Note: *p<0.1; **p<0.05; ***p<0.01			

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