Does Mass Transit Counter the Educational Effects of Residential Segregation in the Metropolitan Area of La Paz-El Alto, Bolivia?

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ABSTRACT

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This dissertation explored the links between residential segregation, transportation policy, and education equity in the metropolitan area of La Paz-El Alto, Bolivia. Using quantitative and qualitative research methods, the study assessed whether mass transit projects counter the educational effects of residential segregation. The specific goals of the study were to:
(a) measure the level of segregation that students experience in neighborhoods and schools;
(b) assess disparities in school accessibility among students of different ethnic and socioeconomic backgrounds; and (c) to measure the effects of mass transit availability on school segregation. The results showed that students in the metropolitan area of La Paz-El Alto are highly segregated by ethnic and socioeconomic background. Moreover, neighborhoods with a higher proportion of either Indigenous or low-income students have lower levels of school accessibility. School accessibility is hindered by the limited supply of schooling and by an inefficient, unsafe, and limited public transportation system. The introduction of high-quality mass transit had a small yet statistically significant effect on school segregation. Students in the lowest third of the wealth distribution are more likely than their wealthier counterparts to change schools when mass transit becomes available. Mass transit projects have thus been a welcome addition to families' transportation options, which highlights the significance of pairing education and transportation policies to promote greater equality of educational opportunity.

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DEDICATION

I dedicate this work to Micaela Belmonte, the love of my life, and to Nicolas and Simona Llanque Belmonte, my two children. They filled me with happiness and joy even as they made sacrifices to help me to finish this project. I will be forever in their debt. I also dedicate this thesis to my parents Armelinda Zonta and Oscar Llanque. Not also did they encourage me to pursue my dreams, but they also taught me to work for a more just world. I also dedicate my work to my sister Aymara Llanque and to my brother Frederick Heumann. They inspired me with their passion for what they do. Finally, I dedicate this thesis to Celestina Fronza, my dearest "Nona Tina," whose seeds will forever live in the garden of my heart.

CHAPTER 1: INTRODUCTION

On December 4, 2014, Bolivia's President Evo Morales inaugurated the Green Line of the *Teleférico*—his signature mass-transit cable car system. This was the third of three lines that were completed since May 30, 2014, which made it possible for people to travel from El Alto to the south of La Paz in around 30 minutes, compared to over an hour by *minibus*, the most widely used public transport mode. Morales made the journey in one of the cable cars from one end of the route to the other, passing by the signs that marked the names of stations in both Spanish and Aymara, which is the second most-spoken language in Bolivia. He boarded his cable car in Ciudad Satélite, a neighborhood in the rapidly expanding city of El Alto where most of the population is Aymara. His cable car made its way down from the plateau over the exposed-brick homes that cover the valley of La Paz's *laderas* (hillsides) before reaching Irpavi, one of the neighborhoods in the affluent Zona Sur of La Paz.

The arrival of Morales' cable car in the Irpavi station of the Green Line was a highly symbolic moment. The armed forces' band welcomed him to the sound of drumbeats, followed by a dance performance of *tinku* by a group of university students. The word *tinku* means encounter in Quechua and physical attack in Aymara, and it is a ritual that predates the Inca Empire. The dance of *tinku* represents the ritual by dramatizing a violent encounter of two groups. Indeed, the opening of the Green Line would soon come to symbolize the tensions of two groups coming together. On January 1, 2015, a series of photographs surfaced on individual and group pages on Facebook. They showed Indigenous people, mostly women, sitting around and eating on the floor of the MegaCenter, a shopping mall located in Irpavi, not too far from the Green Line station. Thousands of people convene in the MegaCenter from all over the city to watch films, shop, eat or simply walk around. These images went viral on the web and were accompanied by debates over acceptable behavior in public spaces, with online commentators slipping into racist language to lament the changes the *Teleférico* had brought.

One of the most widely distributed images surfaced online on January 3, 2015 and it shows a small group of *cholitas* and men sitting on the floor of the MegaCenter, next to a bowling alley (Figure 1). While the word *cholita* comes from the word *cholo* (*chola* for females), meaning mixed-race or pejoratively "half-breed," women in Bolivia have appropriated the term as a source of pride, even if discrimination against *cholitas* persists. On January 7, the national newspaper *La Razón* ran a story on online racism, aggregating many of the comments about the image of *cholitas* in the MegaCenter (Pérez, 2015). Alex D. Flores, who uploaded the image from his mobile phone, wrote, "everyone has the right to be wherever he or she feel like it, but unfortunately we start the year with a postcard that should have a solution." Flores then asked that the management of MegaCenter place benches to "avoid the following image" in which the *cholitas* have a "beautiful day in the countryside." He ended his caption by clarifying that he was not "trying to discriminate." Others followed Flores' lead. Miriam Carvaja wrote, "I hope they will put synthetic turf and plastic flowers hahahaha how sad is our culture!" Miguel Ángel Estenssoro wrote, "Really it is a shame, one doesn't even feel like going to watch movies or eat something" and Mili Sita, wrote, "What a shame to see the MegaCenter this dirty . . . January 1 was chaos . . . there were people eating on the carpet of the ticket window." Similarly, a few days earlier, Mayrita Illanes posted another image to denounce the fact that a group of *cholitas* had left food after they ate on the floor in one of the stations of the *Teleférico* (

Figure *2*).

The commentary went on for several days and brought to light the underlying tensions that continue to surface in the city among ethnic groups, even a decade after Morales, the first

Indigenous president in the country's history, came to power. The unfortunate episode also raised the question of whether the cable car system would be a force for deeper social integration or would accentuate existing social divisions. With close to two million inhabitants, the metropolitan area of La Paz-El Alto is highly segregated along ethnic lines (Gray-Molina, Jimenez, Rada, & Pérez, 2002). A former colonial outpost of Spanish Crown, La Paz-El Alto has historically been divided between neighborhoods where mestizos and Whites live and areas where Aymara or Quechua residents live. As the city expanded in the last three decades due to rural-urban migration, the level of residential segregation has increased with newcomers settling on the peripheral neighborhoods of the city (Gobierno Autónomo Municipal de La Paz [GAMLP], 2006).

Against this backdrop, this dissertation explored the impact of mass transit on the relationship between residential segregation and educational equity in the metropolitan area of La Paz-El Alto. The national government introduced the *Teleférico* for the broad policy aims of stimulating the economy and improving people's "quality of life by connecting them to jobs, health, education, housing and open spaces" (Empresa Estatal de Transporte por Cable "*Mi Teleférico*" [EETC], 2014). In this thesis, I paid attention to the impact of the *Teleférico* on how students get to school, where students go to school, and the social composition of schools. To what extent does the cable car system reduce the adverse effects of residential segregation on schooling? Does mass transit increase school accessibility and reduce school segregation? Using a combination of quantitative and qualitative research methods, I found that the cable car system broadens the schooling options for students; however, non-transport-related factors condition its effects. While students of higher socioeconomic status are more likely to use the cable car system, students who come from families of lower socioeconomic status are more likely to switch schools when the cable car becomes available. The availability of the cable car system has increased the probability that low-income students who live in El Alto enroll in schools of La Paz, changing the social composition of the student body in the schools they attend.

The thesis presents this argument by first documenting the extent of ethnic and socioeconomic segregation in neighborhoods and schools. Using a range of segregation indices, I first show that metropolitan La Paz-El Alto is one of the most segregated cities in Latin America. Second, I show that residential segregation is closely associated with differences in school accessibility. Neighborhoods with high proportions of Indigenous or low-wealth students tend to have fewer schools. Moreover, Indigenous or low-wealth students face a series of barriers that limit their ability to access schooling opportunities, including the lack of transportation options. This study showed that transportation-disadvantaged students have lower levels of access to educational opportunities. In this context, the introduction of affordable, secure, and comfortable modes of transportation can play a significant role in where families send their children to school. In that sense, this study found evidence that transportation policy has an impact on families' schooling decisions, with important consequences for the levels of school segregation that students experience as well as the quality of education they can access.

Significance of the Study

One of the defining features of urbanization in Latin American countries has been the segregation of residents based on their ethnicity or socioeconomic status (Sabatini, 2006). The urban form of the region's metropolitan areas reflects the structural inequalities of post-colonial societies (Angotti, 2013). Low-income residents, Indigenous peoples, and rural-urban migrants tend to live in peripheral neighborhoods that lack access to jobs, resources, and services. Residents of those neighborhoods must spend a significant share of their time and income in intra-urban travel in order to access opportunities (Corporación Andina de Fomento [CAF], 2011). Poor infrastructure such as lack of paved roads, bicycle lines, sidewalks, and bridges, coupled with street insecurity and insufficient or unaffordable means of transport, further constrain the mobility of disadvantaged urban dwellers (Sosa, 2010). In this context of socio-spatial separation, the socioeconomic composition of schools tends to mirror the socioeconomic makeup of the neighborhoods where they are located, contributing to educational inequalities (Reardon & Owens, 2014).

The strong link between school segregation and educational inequalities has been well documented in the comparative education literature (Benito, Alegre, & Gonzàlez-Balletbò, 2014; Montt, 2016). School segregation refers to the degree to which different kinds of people are separated from one another across schools (Massey & Denton, 1988). School segregation can have negative effects on the academic performance of disadvantaged students through “peer effects” (Checchi, 2006; Hanushek, Kain, Markman, & Rivkin, 2003), inequalities in resource allocation (Reardon & Owens, 2014), and the socioeconomic composition of neighborhoods (Bénabou, 1996). In addition, school segregation can reproduce and widen socioeconomic inequality by limiting the social capital that students can accumulate through schooling (Bellei, 2013). School segregation can also limit a society’s ability to maintain social cohesion, contributing to social problems such as crime, violence, and political instability (Billings, Deming, & Rockoff, 2014; Sperberg Fuentealba & Happe, 2000). School segregation undermines democratic national projects because it stands as a barrier to inclusive democratic education, contributing to social divisions based on class, ethnicity, and race (Garcia-Huidobro, 2009). School segregation has thus been a problem of concern for policymakers in a wide range of contexts, including Latin America, where school segregation is arguably more pronounced than in any other region (Murillo, 2016).

Policy interventions designed to address educational inequalities that arise due to segregation include state-funded compulsory education, court-ordered desegregation, and school voucher systems, among others. Among the existing policy options, the use of transportation policy to counter the educational effects of residential segregation received attention in the United States as a part of efforts to desegregate schools (Billings et al., 2014; Clark, 1972). Nevertheless, research in the developing world on the interaction among residential segregation, transportation policy, and educational inequality has only begun to emerge. A number of studies have sought to assess the effect of transportation policy interventions on educational outcomes. Muralidharan and Prakash (2013) showed that provision of bicycles to girls in Bihar, India, increased their age-appropriate enrollment in secondary school by 30% and reduced the gender gap in age-appropriate secondary school enrollment by 40%. In Mexico City, the introduction of new bus rapid transit (BRT) lines to areas with limited access to mass transit in the 2000s allowed high-achieving, low-income students to access schools of relatively higher quality (Colin Pescina, 2015). Another evaluation of BRT lines showed that they significantly improved the accessibility to hospitals, recreation, and libraries around Cali, Colombia (Delmelle & Casas, 2012). These recent empirical studies thus highlight the potential of pairing education policies with transportation initiatives that make it easier for students to access education.

This dissertation built on the existing literature on the effects of transportation policy interventions on educational outcomes. The main goal was to assess the impact of public mass transit systems on school segregation in the metropolitan area of La Paz-El Alto, Bolivia. With a combined population of 1.6 million (Instituto Nacional de Estadística, 2015), La Paz and its neighboring cities constitute Bolivia's largest urban settlement and a case study on urban educational inequality. A survey in 2003 revealed that 25% of the 88,000 adolescents (13-18 years of age) who live in El Alto were not enrolled in schools, compared to 20% of 100,000 adolescents in La Paz (Cuba Oré, 2003, p. 28). The most common reason for adolescents to drop out of school was lack of money, followed by the need to work and to take care of family. Only 20% of the parents of the adolescents in El Alto finished high school or higher, compared to 40% of their counterparts in La Paz (Cuba Oré, 2003, p. 24). Moreover, migrant students are significantly more likely to lag behind and repeat a grade than non-migrant students (Vera, Gonzales, & Alejo, 2011). Taken together, these figures indicate that the lack of access to educational opportunities remains a significant challenge for disadvantaged residents in metropolitan La Paz-El Alto.

At the same time, rapid urbanization and motorization of the metropolitan area of La Paz-El Alto have led to increasingly more congested streets and constrained urban mobility. The population has grown by 21% between 2000 and 2010 (Pando Solares Consultores, 2012). Furthermore, La Paz has one of the highest rates of vehicle ownership in the country. The national rate is 92 vehicles per 1,000 inhabitants, while the figure in La Paz is 224 vehicles per 1,000, excluding vehicles from El Alto that circulate in La Paz (Pando Solares Consultores, 2012). If the number of cars continues to grow at today's pace, we can expect to see twice as many vehicles by 2023. La Paz has 248,000 registered vehicles, of which around 180,000 are in daily circulation. The average speed of vehicle circulation is 7 to 9 miles per hour in the city as a whole, but in the downtown areas, the average speed is 2 to 7 miles per hour (Pando Solares Consultores, 2012). The congestion of streets has thus hit a critical point that required policymakers to come up with large-scale solutions that would facilitate urban mobility and improve quality of life.

In response to this problem, the national government made significant efforts to modernize the capital's public transportation system. In 2014, the national government launched a cable car system to provide public transport to residents in both La Paz and El Alto. As of April 30, 2016, the first three cable car lines delivered over 45 million trips, according to *Mi Teleférico*, the state company that manages the service (Empresa Estatal de Transporte por Cable "Mi Teleférico" [EETC], 2016) . The company also sold over 28,000 student cards, which offer 50% discounts on ticket prices to 3-25 year-old residents enrolled in academic institutions. As of 2015, the company spent 234 million dollars on the project and there are plans to expand the network to cover most of the city by the end of 2017 (*Mi Teleférico*, 2015). While this mass transit project is quickly becoming an important means of mobility for urban dwellers, no documented research has assessed its impact on education. From a policy perspective, an important question to answer is whether the public subsidy on discounted cable car tickets for students can counter the educational effects of residential segregation.

Mi Teleférico has an explicit social mission, which includes providing affordable transportation to the most vulnerable groups in society. This study assessed the educational impact of its subsidies to children and youth. Moreover, Bolivia is not the only country in Latin America that must find answers to the problems of rapid urbanization. In recent years, there has been increased interest throughout the region in innovative solutions to constrained urban mobility in rapidly growing cities. Latin American cities have been home to many of the most progressive mass transit projects in recent decades (Sosa, 2010). From Curitiba and Bogotá to Caracas, Rio and Medellin, many cities in the region have used mass transit with the explicit goals of social integration, poverty, and inequality reduction. Policymakers, architects, and urban planners have introduced or expanded mass transit to reach neighborhoods that have been historically marginalized, stigmatized, and generally excluded from the city. In a study of social urbanism in Latin America, McGuirk (2014) wrote that “the barriers in segregated cities are not just social and psychological: they are marked as much by physical distances and journey times” (p. 166). He chronicled many large public housing projects that fell short of their utopian goals, but noted that some of the most effective urban policies in Latin America have been transport policies. “The answer to a divided city is integration,” he wrote, describing the cable car system in Caracas, “and there is no integration without transport connections” (p. 166).

Many of the mass transit projects that were introduced in Latin America have had an educational mission as well. In Bogotá, the introduction of a Bus Rapid Transit (BRT) system was closely connected to citizenship education. In Medellin, the mayor build a cable car line that connected the city center to Santo Domingo, a *comuna* (slum), located on the hills, that typically remains invisible to the middle-class. Next to the cable car’s final station within Santo Domingo, the urban planners built a “library-park” and a new school. Other cable car projects have been introduced in Rio de Janeiro and Caracas, with varying levels of success. However, the social impact of these projects has rarely been formally evaluated, nor have there been many studies that focused specifically on their impact on education. Therefore, the current study is relevant to broader debates about the impact of mass transit projects on Latin American cities.

These debates have also been incorporated into the global sustainable development agenda. In the Rio de Janeiro Earth Summit in 1992, world leaders noted that rapid motorization was creating problems in growing cities in the developing world, such as accidents and injury, health, noise, congestion, and loss of productivity. Two decades later, the United Nations post-

2015 development agenda included public transport as an essential element of its 11th Sustainable Development Goal (SDG), which committed states to making cities “inclusive, safe, resilient, and sustainable.” The new global policy agenda called on governments to “provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations” (United Nations, 2015a, p. 21). Therefore, the findings of the present study are relevant not just to education policymakers in Bolivia, but also to scholars and policymakers in other contexts who are interested in questions of sustainable urban development.

Structure of the Study

This dissertation is divided into 10 chapters. Based on a literature review, Chapter 2 synthesizes key concepts that can elucidate the impact of mass transit on the relationship between residential segregation and inequality of educational opportunity. Chapter 3 offers contextual background on both educational inequality and transportation policy in the metropolitan area of La Paz-El Alto. Chapter 4 explains the methodological approach used to answer the research questions. Chapters 5-9 show the results. Chapter 5 focuses specifically on documenting the extent of segregation in neighborhoods and schools. Chapter 6 describes disparities in school accessibility based on students’ socioeconomic background as well as their access to motorized transport. Chapter 7 presents accounts from parents who have experienced the challenge of limited school accessibility. Chapters 8 and 9 measure the impact of mass transit on where students go to school through quantitative and qualitative research methods, respectively. Chapter 10 summarizes the key findings and discusses policy implications.

CHAPTER 2: CONCEPTUAL FRAMEWORK

The relationships between residential and school segregation, educational equality and inequality, and accessibility are complex. This chapter presents a conceptual framework that sought to identify the nature of those relationships to derive an empirical model through which to study them. In addition, the chapter synthesizes the existing empirical evidence on the role of transportation in facilitating access to educational opportunities in a variety of contexts. Specifically, the chapter reviews published research that documented the extent to which transportation reduces the educational inequalities that arise from residential segregation. The empirical challenge in these studies has been to separate the influence of accessibility on educational inequalities from the influence of other factors that affect both. To deal with this identification problem, a few studies have taken advantage of changes in policy to assess the impact of transportation on educational inequality, holding residential segregation constant. While this empirical strategy loses power over time, it permits us to see the short-term effects of transport policy on educational inequality. *Figure 3* sums up the ways in which segregation interacts with inequality of educational opportunity. To unpack these relationships, the chapter first defines key terms and then reviews the literature on the causes of each sphere of inequality.

Definitions

The words segregation, accessibility, and educational equality/inequality can individually take a wide range of meanings, let alone together and in relation to each other. At a general level, *segregation* refers to the degree to which different kinds of people are separated from one another across space (Massey & Denton, 1988). Etymologically, the word can be traced to its Latin root *segregatus*, which is the past participle of *segregare*, meaning set apart, lay aside, isolate, or divide. More literally, segregate means to “separate from the flock” from *se* (“apart from") and *grege*, ablative of *grex* ("herd, flock"). The word carries several negative connotations (Table 1) because it signifies an active effort by a group of people to separate itself from another. Originally, the word referred to the religious notion of separating the flock of the godly from sinners. In a modern social context, the word often means the separation and exclusion of different groups of people based on their wealth, race, ethnicity, religion, or migratory status, among others.

When applied to schools, segregation can take several forms such as separation by academic ability, wealth, ethnicity, race, and gender or migration status, to name a few. Moreover, school segregation can refer to different spatial levels of analysis such as segregation in the classroom, in schools, in districts, and in a metropolitan area of multiple districts. The empirical literature has shown that the level of school segregation can vary depending on the kind of index used, the social group of reference, and the dimension of interest (Andersson, Malmberg, & Östh, 2012; Gertler & Glewwe, 1990). Nevertheless, despite the variety of forms that school segregation can take, segregation scholars have identified a set of generally accepted dimensions of segregation, accompanied by a battery of correlated indicators to measure them.

The most commonly measured dimensions of segregation are the degree of similitude (or evenness), isolation (or exposure), concentration, centralization or clustering among different social groups (Massey & Denton, 1988). The evenness and exposure dimensions are most relevant in the context of school segregation, while concentration, centralization, and clustering are more applicable to the study of residential segregation. Evenness refers to the differential distribution of two social groups across schools; a school system is socially segregated if the proportion of students from a social group deviates from the proportion of people in that group who live in the city. In other words, school segregation happens when a type of student is either overrepresented or underrepresented in a school relative to that students' group as a share of the total population. The most widely used measure of evenness is the index of dissimilarity, also known as the Duncan Dissimilarity Index (Duncan & Duncan, 1955). While I discuss the properties of this index later, suffice it to say here that the index conceptually represents the share of students from a group who would have to switch schools for the distribution of students of different groups in the city to be even.

Segregation in terms of exposure relates to the degree of potential contact, or the possibility of interaction, between two social groups within schools. Unlike the dimension of evenness, which measures the distance from an abstract ideal of evenness, measures of exposure capture the experience of segregation as felt by the average member of a social group (Allen & Vignoles, 2007). The degree of exposure or interaction between two groups depends on the size of each group; however, degree of separation from the ideal evenness does not depend on the relative size of the groups. In a city with two social groups, if the minority group is large, its members could be evenly distributed across areal units, but experience little exposure to the majority population. Conversely, if the minority group is very small, its members will experience high levels of exposure to the majority population, even if they are evenly distributed. Therefore, exposure indices take the relative size of social groups into account to measure the degree of segregation.

Taken together, these two dimensions of segregation constitute a basic definition of school segregation. They also help us conceptualize what might be the underlying factors that influence the level of segregation in schools. Because there are various kinds of school segregation, we need specificity about the form of segregation of focus. For this dissertation, I was interested in segregation based on ethnicity as well as socioeconomic status, paying less attention to segregation based on academic ability, gender, disability, and so on. Ethnic and socioeconomic school segregation is a product of complex interactions between economic, political, and sociocultural factors that influence where students live and where they go to school. Both unequal levels of educational opportunity and accessibility are two major factors that produce and reproduce patterns of residential and school segregation.

Residential and school segregation are closely connected to equality and inequality of educational opportunity. Equality generally describes the even distribution of specific goods among members of a society, while the concept of "educational equality" has been closely associated with the ideal of "equality of opportunity." The words equality and inequality carry connotations of fairness and unfairness, equity and inequity, justice and injustice (Table 1), which is why they so often motivate public policies. In the empirical literature on education, the concept has taken on many forms depending on the spaces in which equality is defined. Stromquist (2004) presented a generally accepted typology of four dimensions of educational equality: equality of access (enrollment), equality of inputs (quality of schooling), equality of attainment (also known as survival), equality of output (or learning achievement), and equality of outcomes (or returns to schooling). The concepts of equality and inequality of educational opportunity place the focus of analysis on the ways in which school policy and market forces distribute resources unequally across schools. In other words, they refer to the degree to which different groups have equal access to the inputs that go into educational processes, such as quality of teachers, infrastructure, and other resources that support learning.

Finally, the concept of accessibility carries a specific meaning in the transportation geography literature. Transport is not a good that can be distributed evenly and fairly across members of a society. Rather, transport is a complex aggregation of objects like cars and bicycles; infrastructure like roads and railways; services like public transport lines; safety in the public space; and rules that regulate movement. Martens (2012) identified two ways in which transport has been commonly conceptualized: potential mobility and accessibility. Both concepts refer to people's capacity to overcome the friction of space, with one important distinction. While potential mobility refers to the freedom to move, accessibility refers to the ease with which destinations can be reached from a location. The difference is subtle. Potential mobility can be interpreted as "freedom to choose" where to go, regardless of what the destination is. By contrast, accessibility stresses the limits that distance imposes on people's ability to get to specific locations they need to access. In other words, accessibility links transport to the underlying needs that are met through movement such as getting to school, jobs, health centers, and other places.

A wide range of factors influence accessibility such as the availability of transport, money and time budgets, and the spatial organization of society, all of which can produce disparities in accessibility levels for different persons or places (Martens, 2012). Furthermore, accessibility can be measured either from the point of view of a person or from the perspective of a place. A person can have accessibility depending on how easy it is for him or her to get to places. On the other hand, a place can be accessible or inaccessible, depending on how easy it is for people to get to it from different locations (Páez, Scott, & Morency, 2012). In this dissertation, accessibility was used to refer to students' ability to get to schools of varying quality levels. From a policy perspective, increasing accessibility for students might take place either through an increase in supply of schools close to where students live or through improved ease of movement: better and safer roads, mass transit, bicycles, and the like.

What are the relationships between residential and school segregation, school accessibility, and inequality of educational opportunity? The arrows in *Figure 3* represent the multidirectional relationships between these spheres of public policy. First, income inequality can endogenously determine residential and school segregation, accessibility, and educational inequality patterns. Second, exogenous forces such as public policy and markets for housing, transport, and schooling can have a direct effect on where people live, where they go to school, and how they get from their homes to school. Lastly, residential and school segregation can interact through mechanisms that pertain to both educational inequality and disparities in accessibility. In what follows, I explore more deeply the ways in which these relationships operate.

Determinants of Segregation

While doing a comprehensive review of the residential segregation literature was beyond the scope of this thesis, I relied on existing reviews to identify the factors that matter. Royuela and Vargas (2010) divided the causes of residential segregation between endogenous and exogenous ones. Models of endogenous causes of residential segregation explain it through market mechanisms. The “Bid Rent” model, for example, explains residential segregation as the product of income inequality. In a competitive market for land, there is a rent gradient of declining land prices from the center of a city to its peripheries or from the most desirable to the least desirable land. Moreover, bidders face a trade-off between living space and accessibility to amenities; space becomes more affordable at greater distances from the city center, while transport costs to reach amenities increase. If space is a superior good (as income increases, people demand more of it), the model predicts that low-income households will tend to live close to the city center, while high-income residents will move away from the city center since they can afford to pay for the cost of transport. However, while low-income residents locate centrally because they cannot afford to travel, some high-income households tend to locate centrally as well, either because they value travel time highly or they have a lower preference for living space. Either way, this model explains residential segregation as a direct manifestation of income inequality across the urban space.

Similarly, other models derived from the “Tiebout model” (Tiebout, 1956) formally incorporate existing amenities, including the availability of schools, in their explanations for residential segregation. In this kind of model, people vote with their feet by moving to communities based on their available amenities and tax rates. Under certain assumptions, such as consumers’ ability to choose where they live, zero transportation costs, complete information, among others, these models predict that affluent households will move to communities with greater availability of amenities, crowding out less affluent households who are outbid for the guaranteed access to those amenities. The availability of schools of different quality levels is a classic example of this process, particularly when school funding depends on real estate taxes (Bénabou, 1993). Bénabou (1996) has shown that stratification based on income arises from small differences in family’s endowments, preferences, or access to capital markets. More affluent families move to communities with relatively higher average human capital quality and, in turn, increase the average quality of those communities. Different costs of borrowing limit the ability of less affluent families to move to neighborhoods with higher average human capital. Moreover, affluent families’ ability to produce relatively higher tax receipts generates differences in school funding, which further stratify society with significant implications for intergenerational education and income inequality. People’s decisions about where to live carry with them a set of positive or negative externalities. Therefore, people make decisions about where to live based on the social composition of residents in existing neighborhoods.

Another set of models of residential segregation has been derived from Thomas Schelling's (1969, 1971) classic "spatial proximity model." These models explain aggregate patterns of residential segregation as the result of individuals' "micromotives" or preferences. Individuals' behavior depends on their local interactions with neighbors; people choose where they live based on their preferences for different kinds of neighbors. Individual preference for being surrounded by people of the same background can vary between two extremes: a preference for having no neighbors of the same background to a preference for all neighbors of the same background. We start from a hypothetical scenario where households of different kinds are perfectly integrated or randomly distributed over space. If we introduce a shock whereby a neighbor leaves or a migrant arrives, a chain reaction is triggered as individuals rearrange their residential location until they are satisfied with their neighbors. What is surprising about this process is that individuals' preferences need not be extreme, such as a zero tolerance for neighbors of a different background, for extreme segregation to emerge. Even a small preference for being with neighbors of the same background can produce segregated societies. Individuals might even say that they prefer to live in a neighborhood where they are part of the minority, and they would still end up living in a neighborhood where they are in the majority. This underlying dynamic can also produce segregation in schools, even when individuals would be highly tolerant of diversity within school environments. Families enroll their children in schools where students are likely to be of the same background, even when their level of tolerance for difference is high.

These endogenous models have tremendous explanatory power, yet the dynamics they describe are influenced by exogenous factors such as policy regimes and external market forces (Royuela & Vargas, 2010). For example, residential segregation can be the product of legal systems that regulate where people can live such as racial laws of the Jim Crow period in the United States, Apartheid in South Africa, and the Jewish ghettos in Europe. Other kinds of more indirect institutional arrangements can have the same effect as *de jure* segregation. Zoning laws are a case in point. While they do not explicitly discriminate based on race or ethnicity, they essentially set minimum wealth requirements for residents of neighborhoods, effectively limiting less affluent residents from moving to those neighborhoods. In combination with school admission policies based on neighborhood boundaries, zoning laws can directly produce both residential and school segregation. Since wealth and income are strongly correlated with race and ethnicity, these institutional arrangements reinforce segregation along racial and ethnic lines.

Public housing policy can also have significant effects on residential segregation. State-sponsored public housing projects, which provide housing for low-income families in specific locations, segregate those communities from others. Simultaneously, subsidies that lower the cost of borrowing for home ownership tend to benefit people who are already well off. In the United States, financing mortgages after WWII disproportionally benefited White families (Royuela & Vargas, 2010). Moreover, systematic discrimination in lending practices by commercial banks makes it even harder for low-income families to afford housing. In a summary of the literature, Massey and Denton (1993) showed that high-income African American loan applicants in the 1980s were more likely to be rejected than low-income Whites, and the lending rates were systematically higher for them than they were for Whites. In the context of Latin America, public housing projects have been shown to concentrate poverty in space, while imperfect financial markets negatively affect the ability of low-income families to borrow funds to buy homes (Royuela & Vargas, 2010).

Finally, residential segregation can be closely related to processes of gentrification or decay in real estate markets. Since the value of any given home is co-dependent on the value of the homes around it, improvements in the maintenance of a home in a given neighborhood can increase the price of its adjacent homes. This higher price then incentivizes the owners of those homes to either sell them or making improvements. Either response would reduce the supply of low-value homes, which are replaced by higher-value homes that can only be afforded by more affluent residents. The opposite is true for the decay of the real estate markets as the value of individual homes decline, for instance, due to foreclosures. This kind of spillover effects can reinforce processes of residential segregation, which in turn will affect school segregation.

Determinants of Inequality of Educational Opportunity

So far, my discussion has focused on the determinants of residential segregation and the ways in which they relate to school segregation. In this section, I turn specifically to the determinants of inequality of educational opportunity, one of which has been residential segregation. From an economic perspective, parents' decisions about where to send their children to school can be framed as an investment in human capital—the skills and knowledge that can generate an economic return (Becker, 1964; Schultz, 1971). Individuals seek to maximize their utility by making rational choices about the allocation of their time and resources. Investing in human capital is akin to investing in physical capital in that the decision to invest depends on the marginal returns and marginal costs of each additional unit of investment. Greater utility comes from higher returns to education, which are expressed in terms of future income and tend to rise (up to a point) with increasing levels of investment. As Becker (1964) put it, "persons who invest relatively large amounts in themselves tend to receive relatively high profits and measured earnings after the investment period" (p. 143). The costs of investing in education include direct costs, such as paying for teachers, facilities, resources, and so on, and indirect costs in terms of forgone income due to time away from work and borrowing costs.

Differences in the expected returns and costs of education can thus explain much of the inequality in educational attainment. Beyond compulsory schooling, the human capital model would predict that parents' demand for schooling for their children would be greater if: (a) their children have higher individual talent and expect a higher return from schooling; or (b) parents have higher access to income, wealth or financial markets to finance their investment in their children's education (Checchi, 2006). Assuming talent is randomly distributed among individuals, the second condition alone would produce intergenerational income and educational inequality. Low-income families cannot finance the education of their children, who in turn obtain less education and income, and cannot themselves finance the education of their children.

This relationship between socioeconomic status and demand for schooling contributes to school segregation among different social groups. Families with relatively high-income levels can afford schools of relatively high quality. Moreover, this process of stratification can interact with processes of residential segregation as well. If parents prefer schools that are near their home over schools that are far away, the composition of the student body in any given school will tend to reflect the socioeconomic make-up of the geographical area where the school is located. Socially segregated neighborhoods will thus produce socially segregated schools. Simultaneously, if parents make predictions about the return to schooling based on the social composition of the student body, the demand for schools with a relatively higher socioeconomic status will be greater than the demand for other schools. The interaction between residential and school segregation, therefore, means that the two are closely connected and mutually determined.

The key policy question relates to whether schools reproduce, increase, or reduce the educational effects of residential segregation. Much of the research on this can be traced to James Coleman's (1966) seminal report *Equality of Educational Opportunity*, or *The Coleman Report*. Coleman's report was followed by an extensive literature in economics on the determinants of "human capital formation" (Hanushek, 2016). This research sought to explain educational inequality through "education production functions," which relate inputs (student abilities, schooling resources, family background, cultural environment, etc.) to outputs in terms of measures of human capital such as test scores. Coleman's conclusions have been questioned on methodological grounds (Hanushek, 2016; Rivkin, 2016), but the report was influential in that it suggested that family background was a more important determinant of academic achievement than school characteristics, and that students' peer group composition was more important for learning than any other school-related factor.

Coleman offered the construct of "social capital" to explain the impact of peer group composition on individual achievement. Social capital refers to the relevant factors of the environment that can affect individual behavior: the average abilities of classmates; average incomes, wealth, and educational background of families; and the social networks that can affect the conversion of schooling into opportunity (Checchi, 2006). Students themselves can be inputs in the education production process because of the effects they can have on their peers' learning, which is referred to as "peer effects" (Hanushek et al., 2003; Hanushek, Kain, & Rivkin, 2009). High-ability students can complement each other, providing more insights in class discussions; they can also influence the learning of others as sources of motivation and aspiration, and by setting the average pace of learning in classroom (Checchi, 2006). Consequently, student body composition increases the demand for schools with a greater share of affluent students, contributing to stratification based on socioeconomic status.

Around the same time as Becker and Schultz articulated human capital theory, Milton Friedman published *Capitalism and Freedom* in 1962, in which he argued that the role of the government must be limited to the financing of public schooling, not its provision. In his view, differences in the quality of schooling have been closely related to government provision of schooling. Public schools act like monopolies, insulated from free market competition and indifferent to parental expectations. The average low-income family living in a neighborhood without good public schools is particularly disadvantaged by this system. As Friedman (2009) put it, "The family might be willing to spend something in addition to what it pays in taxes to get better schooling for its child. But it can hardly afford simultaneously to move to the expensive neighborhood" (p. 92). His proposed solution was public financing of education through vouchers that parents can redeem if spent on approved schools of their choice. He advocated for a liberalization of the education industry, allowing schools to operate like private enterprises that competed in a free market for parents' vouchers. Friedman's idea inspired school choice reforms worldwide, yet the empirical evidence on the effects of school choice on educational outcomes remains a subject of debate (Hoxby, 2007). The empirical literature has shown that school choice policies increase social stratification in schools.

Market-oriented mechanisms in school choice systems contribute to social school segregation in several ways. Examples include systems where parents can choose schools and pay with vouchers; systems with a significant share of private schools; or school systems with co-payments in which parents pay additional tuition to enroll their children in public schools

(Valenzuela, Bellei, & Ríos, 2014). MacLeod and Urquiola (2009), for example, introduced a model that explains the counterintuitive empirical evidence that, even though school choice policies lead to parents choosing higher-performing schools, there are no consistent improvements in student learning after choice regimes are introduced. School productivity, in terms of value added, is not the only concern that parents have when they select schools; they are also concerned with the reputation of the school, which depends not only on the school's productivity, but also on the composition of the student body. If schools can select the students they enroll, they will have strong incentives to "cream-skim" students. Therefore, parents might prefer schools with good reputations based on student body composition over the schools that are most productive—the ones that help students learn the most. School choice regimes in which schools can select students tend to produce greater school segregation based on socioeconomic status and ability, without necessarily increasing the average quality of schools in the system.

The empirical literature supports this conclusion. In the case of Chile, school choice policies contributed to an increase in school segregation based on socioeconomic status (Hsieh & Urquiola, 2006). The authors compared communes (or municipalities) with relatively greater private enrollment growth to rural communes, where private school enrollment remained limited, even after school choice policy was implemented. They found evidence of sorting based on ability and socioeconomic status. Middle-class students left the public school system to enroll in private schools, reducing the average socioeconomic status of students in public schools relative to the commune average. The authors concluded that "the main effect of unrestricted school choice was an exodus of middle-class students from the public sector" (Hsieh & Urquiola, 2006, p. 1479). One standard deviation increase in the private enrollment rate was associated with approximately 40% of a standard deviation decline in the relative income of public school parents. This change in the average socioeconomic status of the sending public schools was associated with a decline in the average academic performance of students who remained in those schools. Similarly, Valenzuela et al. (2014) showed that school segregation in Chile has increased due to the introduction of market mechanisms such as school privatization, vouchers, and co-payment schools. Private schools are more segregated than public ones, and larger private school participation in educational markets is not coupled with improvements on the average test scores in national examinations, and it is related to segregated school systems.

In a study of school choice reform in Sweden, Böhlmark, Holmlund, and Lindahl (2016) provided descriptive evidence that in regions where school choice was more prevalent, school segregation based on immigrant and socioeconomic status has increased more than in regions where school choice was limited. The authors estimated the influence of three determinants of school segregation: neighborhood segregation, parental choice, and indirect cream skimming through schools' location choices. School choice was introduced in 1992, leading to the emergence of "independent schools," at different levels of intensity across municipalities. The authors exploited variation over time as well as variation across space to assess the associations between school segregation and the determinants of interest. Neighborhood segregation was the main explanation for school segregation, even after the reform was implemented and parents could opt out of their assigned schools. In a different study of the same reform, Bohlmark and Lindahl (2007) confirmed the finding that school choice is associated with increased school segregation. They modeled the ratio of "quality" pupils, those who score more highly on measures of status such as parental income and education, and first- or second-generation immigrant status, over time and across different municipalities with differing levels of private school enrollment growth. While they found no evidence of sorting of pupils by parental income and pupil's first-generation immigrant status, the authors did find that more private schooling makes public schools lose pupils who are second-generation immigrants and/or whose parents have high education. Hence, an effect of increased school choice in Sweden, following the 1992 school reform, has been greater segregation based on parental education and immigration status.

Proximity to Schools

Part of the literature on the effects of school choice policy on school segregation has focused specifically on the role that proximity plays in parents' decisions about schooling (Andersson et al., 2012; Gómez, Chumacero, & Paredes, 2012; Hastings, Kane, & Staiger, 2006). At least two processes are at play in the way proximity shapes parents' decisions. On one hand, the distance between home and school might influence parents' decisions due to differences in their preferences; when faced with the trade-off between school quality and proximity, they might choose proximity even if school quality is lower. On the other hand, distance shapes parents' decisions because travel costs increase the overall cost of schooling, reducing overall demand for schooling. Families exit the market when the cost of travel makes their preferred schools unaffordable. Either way, the distance between home and school limits the potential of school choice to reduce school segregation based on residential location.

The empirical literature supports both of these mechanisms. Hastings et al. (2006) showed that in Charlotte-Mecklenburg, North Carolina, parental preferences varied across socioeconomic groups, with low-income families exhibiting a preference for proximity over academic quality. Parental preference for measures of academic quality increased with higher levels of income as well as student baseline achievement. Most parents highly valued proximity, but some parents with strong preference for academic achievement were willing to leave their local neighborhood to get it. Children of parents who valued quality of education more than proximity had relatively high levels of academic achievement. By contrast, the opposite was true for children of parents who preferred proximity to quality. Their study suggested that parental preference can vary and explained why parents who placed a low value on academics chose proximal schools over distant ones, even if the latter were accessible and of greater quality. If high-income families and parents of high-achieving students focus on academics when choosing schools, while low-income families focus on proximity, then schools become more stratified under school choice regimes.

Similarly, low-income families in post-Katrina New Orleans were more likely to select low-performing schools close to home than high-performing schools far from home (Harries & Larsen, 2014). Extracurricular activities and indirect costs such as distance are, collectively, at least as important as academic quality. Increasing the ranking of schools by the equivalent of one letter grade on an A-F scale increases the odds of a school being top-ranked by families by about 30%. Increasing driving distance by one mile reduces the odds of ranking a school highest by about 40%. Together, these estimates suggest that one letter grade is equivalent to three-quarters of a mile in driving distance. Additionally, some families view the nearest school as the default choice, even when there is another viable school option slightly farther away. Parental school choice might not necessarily lead socioeconomically disadvantaged families to choose academically stronger schools for their children.

Like Hastings et al. (2006), Harries and Larsen (2014) argued that low-income families might have different preferences. Low-income adults tend to have lower education levels themselves, which may reflect weaker revealed preferences for academics. Moreover, since low-income students tend to have lower test scores, families may perceive that their children will be more comfortable and successful if their classmates are more similar academically. Even among parents with the same schooling preferences, there are three reasons to expect lower-income families to have weaker demand for academics. Diminishing marginal utility from income means that any indirect costs that involve financial expenditures yield greater utility losses for low-income families, making them less willing to incur those costs, including the cost of transportation. Compounding this effect, some of the family inputs in the education production function are part of the household production and utility functions. Low-income families are less likely to own automobiles, which increases the marginal cost to families of sending their children to schools farther away. Finally, school choices might differ because low-income families are less well informed about the true characteristics of schools. If they really do have weaker preferences for education, they would be less willing to incur the cost of information gathering (e.g., visiting schools, attending school fairs, and talking with neighbors who have direct and recent school experiences). All of this may be reinforced by social networks, in which people tend to associate with and gather information from others like themselves. More broadly, people with lower levels of education seem to be more efficient consumers, making decisions more in line with their preferences. Harries and Larsen (2014) found that distance plays a consistent role from kindergarten through Grade 4, then diminishes in Grade 5 and again in Grade 9. Parents want to be in closer proximity to their younger children, but are less concerned about this as their children become older and demand more in their academic and extracurricular programs.

Evidence from Chile also suggested that the probability of attending the school that is closest to home decreases with higher socioeconomic status. Gómez et al. (2012) used a binary discrete choice model that considered student characteristics, and differences in the characteristics of the nearest school and the chosen school. The study tested the hypothesis that parents faced a trade-off between school quality and proximity. Parents preferred schools that were closer to home; they also preferred schools of higher quality. When they could not get both, they faced a tradeoff. The probability of enrolling their children in the nearest school varied in relation to the student age, gender, and mother's education and income level. Students of highly educated mothers were less likely to enroll in the nearest school. The preference for the nearest school went down with distance to nearest school. The quality of the chosen school decreased the probability that a student would chose the nearest school. The quality of the nearest school was a more important determinant in 2003 than in 1996 after more public information about school quality was released. The authors argued that information about the quality of schools played an important role in determining parental school choice.

In the context of Sweden, Andersson et al. (2012) found that distance to school had a significant negative effect on the probability that parents would send their children to a school other than the one close to home. Families of "visible monitories" were particularly more likely to forgo their opportunity to exercise school choice: they would send their children to schools that were closer to home even if they were of lower quality in terms of academics. The authors were concerned with the relationship between socio and ethnic background, and geographical school choice in Sweden. They defined "geographical school choice" as the distance between the nearest school to home and where a given student goes to school. A given student exercises school choice when he or she chooses a school that is not the one closest to home. The dependent variable, therefore, is "the ability/possibility to use school choice as measured by distance from home to school." In other words, they were looking at the determinants of distance to school. They also distinguished between situational and positional capital. Situational capital refers to the ability to overcome the cost barrier to take advantage of opportunities that are far from home, while positional capital refers to the opportunities are available close to home. Using data for

15-year-olds in Sweden in the 2000s, the authors tested the theory that students who had low "positional capital"—that is, the opportunity to study near their residence—were more likely to travel long distances. Students who belonged to a visible minority might choose the nearest school not just because of lack of money to travel long distances, but also as an act of resistance, to avoid feeling like a minority. The study concluded that school choice policies in Sweden had an adverse effect on equity in the educational system.

Transportation Policy Interventions

In previous sections, I explored the ways in which contextual factors, such as residential segregation, and institutional arrangements, such as school choice policies, contribute to school segregation. I also reviewed studies that showed that residential segregation relates to school segregation through distance as the main mediator. Distance to schools can limit families' ability to send their children to schools that are less segregated than the ones closest to home. In this section, I explore studies that have paid attention to the role that transportation policy interventions can play in reducing school segregation by easing the friction of distance between home and school (Colin Pescina, 2015; Combs, 2013; Delmelle & Casas, 2012; Muralidharan & Prakash, 2013). The role of transportation depends on the conditions in which it is introduced as a counter to the school segregation.

Transportation policies that explicitly aim to even out the distribution of students of different social groups can significantly contribute to the school segregation. The best example of this kind of policies come from the United States' desegregation efforts in the 1960s through the busing of African American students to integrated schools in affluent, predominantly White neighborhoods. Desegregation busing was implemented in major cities to redress prior racial segregation of schools, or to overcome the effects of residential segregation on local school demographics. Court-ordered busing programs typically sent Black students to schools that were previously all-White and vice versa, often in the face of resistance from local school boards and other elected officials. In a review of this literature that evaluated desegregation programs, Rivkin (2016) found evidence that desegregation had a positive but likely uneven effect on academic outcomes, particularly for students of disadvantaged backgrounds. However, the absence of an evaluation component from desegregation programs has complicated efforts to measure short- and long-term program effects. James S. Coleman (1975) famously argued that court-ordered busing accelerated the exodus from central cities ("White flight"), sparking a literature that looked at the impact of desegregation efforts on racial mixing in schools.

More recent examples of these studies have captured significant effects of busing on desegregation in schools. Angrist and Lang (2004) looked at the Metropolitan Council for Educational Opportunity (Metco) desegregation program, which sent students from Boston schools to more affluent suburbs. Metco is voluntary on the part of both the families of students being bused and the school districts receiving the bused students, and has not been associated with White flight. They found that Metco significantly changed the racial composition of the schools where students were being bused. Families from Boston did take advantage of the program. In addition, Metco reduced average test scores in receiving districts, but Metco participation had a negligible effect on the scores of White students in receiving districts. This finding was consistent with the hypothesis that Metco participation had no negative externalities, even though Metco participation clearly did have composition effects.

Another example came from Charlotte-Mecklenburg, North Carolina, where race-based busing had been in place since the 1970s, reaching high levels of integration by the 1980s before being discontinued in the early 2000s. Looking at the impact of the termination of this policy, Billings, Deming, and Rockoff (2014) concluded that the end of race-based busing widened racial inequality, despite efforts by school system to mitigate the effect of segregation through compensatory resource allocation. In 2001, school boundaries were redrawn dramatically, and half of students received a new assignment. Using addresses measured prior to the policy change, the authors compared students in the same neighborhood who lived on opposite sides of a newly drawn boundary. Both White and minority students scored lower on high school exams when they were assigned to schools with more minority students. They also found decreases in high school graduation and college attendance for Whites and large increases in crime for minority males.

Outside of the United States, in contexts where public schools are not required to provide transportation to students, studies have focused on how public transit systems contribute to parents' decisions about where to send their children to school. If distance is such a significant constraint to families' ability to send their children to better schools, would the introduction of low-cost, time-saving modes of transportation increase the probability that students enroll in relatively high-quality schools that are far from home? In Mexico City, the introduction of new bus rapid transit (BRT) lines in the 2000s allowed students to access schools of relatively higher quality. Colin Pescina (2015) showed that areas of Mexico City with limited access to mass transit had a higher share of high-achieving, low-income students who were enrolled in relatively lower-performing schools, which he referred to as under-matching. Colin Pescina compared the school choices of students in *colonias* before and after new bus lines were introduced. To control for parallel trends, he used a difference-in-difference technique that took into account factors that changed over time other than the introduction of the new bus lines. He found that the introduction of new bus rapid transit (BRT) lines in the 2000s allowed high-achieving students to choose high-performing schools that were farther from their residence. The greater benefits accrued to students in the middle and lower part of the academic distribution. Transit improvements decreased the level of under-matching for these students. At the same time, the bus lines had an impact on the schools as well. Students in wealthier areas saw the quality of their school peers decrease after transit lines started operations.

Other impact evaluations have focused not on schools per se but on accessibility to urban amenities that would supplement education. One study evaluated the impact of development of Bus Rapid Transit (BRT) systems in Cali, Colombia (Delmelle & Casas, 2012). The purpose of the study was to explore the spatial accessibility the landscape created by the newly implemented BRT system in terms of both access to the system itself and accessibility to hospitals, recreation, and libraries around the city. The authors compared the distribution of accessibility by socioeconomic status. Their findings indicated that walking access to the BRT system was the greatest for middle-income groups and the most limited for neighborhoods in the highest and lowest socioeconomic strata. They also found that libraries tended to cluster in the center of the city and the BRT had become crucial for children and youth to access those facilities.

However, the impact of mass-transit options on urban mobility for urban residents who have the lowest levels of income is not always clear. Part of the problem relates to the high cost of travel, even with the reduction in time and fares that comes about due to the introduced mass transit. In an assessment of the impact of the BRT in Bogotá, Colombia, Combs (2013) found no evidence that mass transit had a significant impact on a mobility measure of car-less households. The study used mobility measures such as non-car travel frequency for a variety of purposes, including school attendance, and found that the introduction of the BRT system did not significantly affect low-income households' behavior. The author hesitated to conclude that this result meant the BRT system has no impact on travel patterns of low-income residents, and attributed the results to potential limitations in measures of mobility. Nevertheless, this study was not alone in raising questions about the actual impact of mass transit on the very poor (Delmelle & Casas, 2012). The reduction of travel cost might not be sufficient to increase access to all. Therefore, it is important to conduct more empirical research to assess how mass transit affects the behavior of those who are most disadvantaged by the lack of transportation options in Latin American cities.

Finally, transportation initiatives have also been used to boost demand for schooling as a form of "conditional kind transfer." Although the provision of schooling has already been expanded significantly worldwide, low-income families tend to underinvest in education. Therefore, several governments have opted for various forms of conditional cash transfers (CCT) programs that give money to low-income families if they use it to invest in human capital by sending their children to school or bringing them to health centers on a regular basis. A few of the most well-documented programs of this kind were implemented in Latin America, such as the *Programa Opportunidades de Desarrollo Humano* (Human Development Opportunities Program) in Mexico and the *Bolsa Familia* in Brazil, to name a few (De la Peña, 2016). Rawlings and Rubio (2005) summarized six impact evaluations that used experimental or quasi-experimental research methods to specify causal links between conditional cash transfers and measures of investment in human capital such as enrollment and attendance. These evaluations found positive results in increased enrollment, although the impact on attendance and performance was mixed.

The distributional transfers to low-income families can influence their investment behavior. One program in Bihar, India, applied this concept to improve school access for ninth grade girls by providing them with funds to buy a bicycle (Muralidharan & Prakash, 2013). The "Cycle Program" was thus conceived as a "conditional kind transfer" (CKT) and had features of both demand and supply-side interventions. The enrollment conditionality is analogous to demand-side CCT programs, while the bicycle mimics the characteristics of a supply-side intervention by reducing the time, distance, and safety cost of attending school. The program has proven to be politically popular and has been replicated in other states across India. Muralidharan and Prakash (2013) showed that the provision of bicycles to girls increased their age-appropriate enrollment in secondary school by 30% and reduced the gender gap in age-appropriate secondary school enrollment by 40%. The lack of any impact on the number of girls who passed the exam suggested that the increase in enrollments may not have translated into learning improvements, and was consistent with evidence on conditional cash transfer programs from around the world that found impacts on enrollment but not on achievement.

Random Utility Model

This literature review discussed the complex relationships between residential and school segregation, school accessibility, and equality and inequality of educational opportunities. In this section, I present a simple model of school choice that takes mass transit availability into account in processes of school segregation and generation of educational inequalities. Specifically, the impact of mass transit on households' decisions about where to send their children to school can be modeled using a discrete choice model derived from a random utility model framework in which decision makers are assumed to be utility maximizers (Colin Pescina, 2015; Hastings et al., 2006). The decision maker, in this case the parent(s) of student *n*, faces a choice among *J* alternative schools. The decision maker obtains a certain level of utility from each one of the alternatives, which we denote as $U_{nj}, j = 1 \dots J$. Parents follow a simple decision rule to select a school: they choose the school with the highest utility; that is, they would choose school j if and only if $U_{nj} > U_{ni}\ \forall\ j \neq i$. The values that their choice y_{nj} can take are given by:

$$y_{nj} = \begin{cases} 1 & U_{nj} > U_{ni}\ \forall\ j \neq i \\ 0 & otherwise \end{cases}$$

Because I cannot observe the utility levels directly, I must estimate the representative utility based on a set of observable attributes of the schools $x_{nj} \forall j$, and some attributes of the decision maker s_n such that $V_{nj} = V(x_{nj}, s_n) \forall j$. Since there are unobservable factors that influence utility but are not captured in V_{nj}, we know that $U_{nj} \neq V_{nj}$. Instead, we specify the following utility function:

$$U_{nj} = V_{nj} + \epsilon_{nj} \tag{1}$$

where V_{nj} denotes the systematic component of the decision maker's utility and ϵ_{nj}denotes the stochastic component of the utility function. The joint density of the random vector $\epsilon_n = \{\epsilon_{n1}, \dots, \epsilon_{nJ}\}$ is denoted $f(\epsilon_n)$. V_{nj} in turn depends on a function v of school characteristics S_j (e.g. reputation, quality, racial composition, etc.), student characteristics I_n (e.g. race, gender, wealth, etc.); and the cost of travel from home to school T_{nj} such that:

$$V_{nj} = v(S_j, I_n, T_{nj}) \tag{2}$$

Certain school characteristics can have a direct impact on the students' utility in terms of the quality of their experiences such as amenities available in the school. Other characteristics are more directly tied to learning, such as teacher quality, peer composition, and books, with the potential to increase utility in the long run, based on greater returns to schooling. Moreover, student characteristics influence the choice of school based on differences in income, tastes and preferences, and individual ability. Lastly, equation (2) captures the impact of travel effort on a student's utility (Colin Pescina, 2015). I assume an inverse relationship between the two: the change in utility that results from a change in travel effort is negative; for incremental units of travel effort, the level of utility declines. Moreover, travel effort depends on a function g of D_{ij}, which is the distance from home of student *n* to school j, and M_{nj} which represents person accessibility from home to school, or the ease of movement from home to school based on a combination of factors such as road quality, availability of mass transit, safety, and so on.

$$T_{nj} = g(D_{nj}, M_{nj}) \tag{3}$$

The distance from home to school would have a positive relationship with travel effort, while the availability of mass transit would be inversely related to the effort of getting to school. For instance, for two schools that are equidistant to a student's home, the student would choose the school that is easiest to reach *ceteris paribus*. Mass transit would thus influence the choice of school by improving the ease of movement from home to specific schools in the students' choice set. While I cannot estimate this model directly, I can use a reduced form linear probability model that identifies the average effect of mass transit on students' choice of school. I test the hypothesis that mass transit availability alters students' choice of school from schools that are proximal to home to schools that are farther away from home. Before I can test this hypothesis, we need more information about the context in which the mass transit system was introduced.

CHAPTER 3: CONTEXTUAL BACKGROUND

The metropolitan area of La Paz-El Alto provides a unique backdrop for the study of the impact of mass transit availability on families' decisions about schooling. This chapter describes the context in relation to broader patterns of urbanization, segregation, and transport systems in Latin America and in Bolivia. In the last couple of decades, mass transit projects have become common instruments of "social urbanism" aimed at dealing with the challenges that come with greater urbanization. Policymakers in the region have come to see mass transit projects as a powerful way to improve access of services for the transportation disadvantaged. In Bolivia, mass transit projects have been at the center of public policy debates about urban development in La Paz-El Alto. Moreover, these debates have intersected with education policy efforts to improve access to quality schooling in order to reduce historic educational inequalities between Indigenous and non-Indigenous students.

Latin America in Context

With close to 80% of its population living in urban areas, Latin America is more urbanized than Europe (72%) and almost as urban as North America (82%), according to the most recent *World Urbanization Prospect* (United Nations, 2015a, p. 1). Scholars have often noted that more than half of the world's population now lives in urban areas, yet Latin America has lived in that reality for decades. The region's urban population was 40% in 1950 and the most significant growth took place in the following two decades. The pace of urban growth has decelerated in the 21st century, but the urban population is expected to grow from 495 million today to 674 million by the middle of the century. Despite urbanization in Asia and Africa, Latin America will still be home to around one in five of the world's urban dwellers in 2050. These figures suggest that the region's ability to deal with its most intractable problems—inequality, poverty, social exclusion, and environmental degradation—will be enhanced or hindered by what happens in cities.

Economic inequality has left a profound mark on Latin American urban landscapes. The region might be better off economically than much of the global south, yet it retains the highest level of economic inequality in the world. In Latin America, the richest 20% earns 12 times more than the poorest, twice as much as in the world's richest nations (Perlman, 2010). Consequently, Latin American cities have taken socially segregated urban forms that mirror the inequality of their societies. UN-HABITAT (2003), in its landmark report *Challenge of Slums*, estimated that 32% of the urban population in Latin America lived in squatter settlements as of 2001 (p. 14). Making up 14% of the world's "slum dwellers," more than 128 million people live in informal shantytowns in Latin American cities. These settlements take different local names such *favelas* (Brazil), *colonias* (Mexico), *comunas* (Bogotá, Colombia), and *villas miseria* (Argentina), and so on, but they share associations with poverty, crime, poor access to services, low-quality housing, and insecure land tenure, among other attributes (UN-HABITAT, 2003, p. 13). In some cases, squatter settlements are home to vulnerable groups such as immigrants, internally displaced persons, or ethnic minorities.

Indigenous peoples constitute an increasing share of Latin America's urban population. The 40 million Indigenous people who live in Latin America represent 13% of the region's total population and 40% of its rural population (International Work Group for Indigenous Affairs, 2014). At the turn of the century, 40% of the region's Indigenous population lived in urban areas, with significant variation across countries (Del Popolo, Oyarce, Ribotta, & Rodriguez, 2007). In some countries, the high percentages of Indigenous population in rural areas correspond to ancestral territories and displacement areas to which they have been reduced. In Costa Rica, Ecuador, Honduras, Panama and Paraguay, only 20% of the Indigenous population lives in urban areas. By contrast, in Guatemala and Mexico, 30% of the Indigenous population lives in urban areas. In Bolivia, Brazil and Chile over half of the Indigenous population live in cities, but they are the majority only in the case of Bolivia.

Indigenous peoples often live in areas that are segregated from non-Indigenous residents. Del Popolo et al. (2007) measured the degree of evenness in the distribution of Indigenous and non-Indigenous peoples in several Latin American cities. They found that cities like Mexico City, Santiago, São Paulo, and Guatemala City had low levels of segregation, while La Paz, San José, Quito, and Panama City had higher degrees of spatial segmentation. Moreover, the same authors measured how concentrated Indigenous peoples were in each territorial unit within cities. They found that the degree of concentration of the Indigenous population within the sampled cities is systematically higher than that of the non-Indigenous population. Asunción, San Pedro Sula, Guatemala City, and Mexico City display the highest levels of concentration of Indigenous populations.

Most Latin American cities sprawl out of a central area, with neighborhoods of less affluent residents located in the peripheries, though in a few cities shantytowns can be found scattered near the center as well. Peripheral shantytowns tend to form by households who have invaded usually public land, or they occupy land that has been subdivided and for which they have paid or entered a rent-purchase agreement with the developer or landowner. Low-income households choose those areas because there is less competition for land use and they can find more space than in other parts of the city. The houses they build might be better than in rural areas, but the main problem is the quality and level of services. One of the most significant problems facing peripheral urban dwellers is the low level of access and high cost of transport to jobs, markets, schools and centers of administration of public services (UN-HABITAT, 2003, p. 90). Households living in peripheral areas can spend up to 30% of their incomes on transport, or as much as 3 to 4 hours a day walking to and from work and school.

This problem is compounded by the cost of movement in increasingly congested cities, which has resulted from the growth in number of automobiles in the developing world. Urban dwellers in Latin American cities, as in the rest of the developing world, often have to live with the traffic that gridlocks the streets. Mike Davis (2006) in his book *Planet of Slums* notes how the combination of urban sprawl, lack of social investment, and poor mass transit or road infrastructure has made traffic a “public health catastrophe” in the developing world (p. 131). This is in largely the result of rapid motorization. In 1980, the “Third World” accounted for only 18% of global vehicle ownership; by 2020, about half of the world’s projected 1.3 billion cars, trucks, and buses—along with several hundred million motorbikes and scooters—will add to the congested streets of the “Third World” (Davis, 2006). Of course, the main driver behind motorization is economic growth, but inequality also plays an important role. In most cities, transportation suffers from a vicious cycle in which the declining quality of public transport reinforces private auto use and vice versa.

Bolivia in Context

While the world’s megacities, such as Mexico and Sao Paulo, tend to get the most press, only 1 in 8 of the world’s urban dwellers live in them, compared to 1 in 5 who live in medium-sized cities with 1 to 5 million inhabitants (United Nations, 2015a). Medium-sized cities are the largest cities in 79 countries, their combined population nearly doubled between 1990 and 2014, and their size is expected to increase by another 36% by 2030. The largest cities in Bolivia—La Paz, Santa Cruz, and Cochabamba—are medium-sized cities that have grown at annual rate of

6% in the last 5 years, compared to the annual rate of 3% for the region as a whole. The urban population in Bolivia nearly doubled from 3.8 million in 1990 to 7.4 million in 2014. As a share of the total population, Bolivia's urban population is thus on its way to match regional levels: it increased from 56% in 1990 to 68% in 2014, and it is projected to reach 79% by 2050 (United Nations, 2015a, p. 24).

As in other Latin American cities, the presence of Indigenous peoples in Bolivian cities can be traced back to the colonial era. In fact, as the centers of power, the cities were often the target of major Indigenous rebellions. *Figure 4* depicts the months-long siege by Julian Apaza (Tupac Katari) in Alto Perú in 1780. This image of colonial La Paz captures the basic features that characterize the colonial model of urban space, many of which survive into the present day. The Spanish colonists placed the center of power around the *Plaza Murillo,* where the city's main cathedral and the colonial administration are located. The streets are ordered in a grid that stretches in all directions up to the city limits, delineated by natural barriers like rivers or city walls. Within those borders were the homes of *Criollo* military families, clergy, and other colonial administrators. On the other side of the river, the artist depicted the Indigenous rebellion, which had laid siege to La Paz for months. The painting also shows the farmland where Indigenous people produced food for the urban residents, with several churches that fulfilled their evangelizing mission.

The ordering of the space along ethnic lines has thus been a defining feature of cities in Spanish America. It is also one of the most persistent legacies of the period. The basic structure of urban form remained remarkably consistent with this model, even though internal population growth and rural-urban migration have increased the size of the city. The grid of the city's center around *Plaza Murillo*, where the government buildings and the cathedral are still located, remains intact. Much of the urban growth of the last century took place on the hillsides around the center and over the flatlands that sit atop them. El Alto City was a transitional neighborhood of La Paz for most of the 20th century, where rural-urban migrants would temporarily settle in the hopes of making a life in La Paz. Eventually, it became its own city and it is now home to close to one million people, most of whom self-identify as Aymara.

Bolivian cities are highly segregated along socioeconomic and ethnic lines. A study from the Interamerican Development Bank found that largest settlements in the country are also the most segregated: La Paz-El Alto, Santa Cruz, and Cochabamba (Gray-Molina et al., 2002). In the case of La Paz-El Alto, the authors distinguished between segregation due to different waves of rural to urban immigration. The migration that took place in the third quarter of the last century increased the share of the Indigenous population significantly. During the 1970s more than two thirds of the city's residents were Aymara speakers and in several neighborhoods, were only inhabited by Aymara speakers. During the 1980s, there has been significant urban growth leading to highly dense areas in both high-income and low-income neighborhoods across the metropolitan area. The 1982-1985 drought induced a wave of rural migrant households that settled in 36 of the 43 neighborhoods that the authors sampled in their survey. By the end of 1990s, Aymara speakers made up more than half of the population in the average neighborhood, ranging from 80% to 23% across neighborhoods. These patterns of segregation, the authors found, have had a significant impact on a range of social measures, including educational outcomes.

More recently, studies from the municipal government of La Paz have shown persistent patterns of segregation in the city (Gobierno Autónomo Municipal de La Paz (GAMLP), 2006). For example, using census data from 2001, the study shows that residents who self-identify as

Aymara are more concentrated on peripheral neighborhoods of La Paz. Neighborhoods where at least 80% of the residents self-identify as Aymara are located away from the central district. By contrast, neighborhoods where less than 30% of the population in the census self-identify as Aymara are proximal to the central district. Mostly mestizo and White residents inhabit the city center and the neighborhoods that stretch to its South East along the city's old waterways. Aymara residents mainly inhabit the western peripheral neighborhoods, which stretch onto the highlands over what is now El Alto city. Peripheral neighborhoods South and South East of La Paz have emerged in the last few decades. Many of them were previously rural communities that are now joined by La Paz, and their population, as the map shows, mostly consists of Aymara residents.

In addition to residential segregation, Bolivian cities are also experiencing many of the problems that come with urban sprawl and automobile ownership expansion. The mode of transport choice varies depending on people's socioeconomic status. Most people move around the city using privately operated public transport: 85% of the trips in La Paz and 93% in El Alto are done with public transport. The rest of motorized transport takes place with either private cars or taxis. People travel by foot or bicycles around 25% of the time, but this mostly happens in peripheral neighborhoods where population density is too low for private transport providers to make money. Indigenous peoples living in peripheral neighborhoods rely on public transportation. They are more likely to suffer from limited access and poor quality of transport, and they spend a larger share of their income on transportation. In La Paz-El Alto, families in the lowest socioeconomic quartile spend as much as 45% of their income on transportation; families in the richest quartile spend between 6% and 15% (Pando Solares Consultores, 2012). Therefore, the transportation disadvantaged tend to be Indigenous low-income families who live on the edges of the city. I next discuss how this problem intersects with challenges in the provision of quality education for Indigenous children and youth.

Educational Inequality in Bolivia

The socially differentiated urban space of Latin American cities is closely related to educational inequalities. Bolivian cities are no different. The main theme of the history of education in Bolivia has been the tensions between the elites who sought to use education to maintain power and the Indigenous majority who used it to resist marginalization. Spanish has been the official language since colonial times, and the exclusive language of public education since independence in 1825, even though a majority of Bolivians did not speak it until the 1970s (Luykx & López, 2007). Education policy has historically oscillated between the outright exclusion of Indigenous peoples and their assimilation. For much of the republican era, the *Criollo* landowning elites resisted Indigenous education because it was a threat to their power. Clandestine schools appeared by the beginning of the 20th century, but they were often destroyed and their teachers brutally repressed. A remarkable exception was the *Warisata* School (1931-1941). Founded by *mestizo* educator Elizardo Pérez and Aymara leader Avelino Siñani, the school instituted bilingual education, community control over school decisions, and other strategies akin to what is nowadays called intercultural education.

In the post-revolutionary period, there was a significant increase in the number of students in rural areas, largely due to land reform, which eliminated the landowners' resistance to rural education. A major challenge for the state was the integration of the rural majority into the economic and cultural life of the urban minority. The state instituted mass education to bring Indigenous people into the fold of national culture and economy under the imported model of the uniform and homogeneous nation-state (Luykx & López, 2007). In other words, the aim of

Bolivian schooling has historically been to remake Indigenous people as “Bolivian citizens” (Luykx, 1999). This was the rationale for the expansion of rural education in the second half of the 20th century. At the turn of the century, 85% of Bolivian children ages 6 to 14 were attending schooling, but enrollment remained lower in rural areas. Gaining access to secondary education was a challenge for most rural students and postsecondary education was out of reach for all but a few.

During most of the 20th century the education system maintained the colonial legacy—the curriculum remained centrally dictated, though corporal punishment was largely phased out, the content was based on values and practice of the mestizo middle and upper classes, with no input from teachers, students, or parents. Education had a civilizing intent to transform a “backwards race” into a useful labor force. During the 1980s and 1990s, urban areas saw a proliferation of private schools and many public school began to charge parents monthly *cuotas*, which were supplementary fees that would allow the schools to pay teachers to not strike. The low quality of public education and the frequency of strikes lead some families who can afford it to send their children to private schools, though it is unclear that the quality of those schools is any better. Only 11% to 13% of Bolivia’s student enrollment corresponds to private education (Luykx & López, 2007, p. 43).

The education reform of 1994 introduced several changes with progressive goals such as gender equity, local control, and bilingual intercultural education. The law drew in criticism from not retraining teachers, decentralizing education (seen as a step to privatization), and shifting the financial responsibility to the local level. The idea of recognizing Indigenous languages and cultures was well received, but difficult to put into practice. In the 2000s, the 1994 law was abrogated and Indigenous organizations pushed strongly for the radicalization of bilingual-intercultural education. The concept of citizenship is undergoing a rapid transformation, accompanied by evolving notions of an ethnically differentiated citizenry as well as the constitutionally established ideal of intercultural citizenry that includes all Bolivians, Indigenous and non-Indigenous.

Still, several challenges remain in putting the education law into practice, including the deeper integration of Indigenous and non-Indigenous populations in urban areas. A survey in 2003 revealed that 25% of the 88 thousand adolescents (13-18 years of age) who live in El Alto, a city that is practically part of La Paz, were not enrolled in schools, compared to 20% of 100 thousand adolescents in La Paz (Cuba Oré, 2003, p. 28). The most common reason for adolescents to drop out of school was lack of money (40%), followed by the need to work and take care of family. Only 20% of the El Alto adolescents' parents finished high school or higher, compared to 40% of their counterparts in La Paz (Cuba Oré, 2003, p. 24). Moreover, even within La Paz alone, there is significant variation in educational attainment. Tertiary educational attainment varies across neighborhoods in a similar pattern to the general socioeconomic segregation of the city. The neighborhoods where at least half of the adult population has attained partial tertiary education or more live in the center and South East of La Paz. By contrast, the neighborhoods where less than 10% of the population attained tertiary education are mostly located on the edges of the city.

These patterns of educational inequality are also closely associated with differences between migrant and non-migrant students in the city. Moreover, migrant students are significantly more likely to lag behind and repeat a grade than non-migrant students (Vera et al., 2011). A study from the Bolivian Ministry of education and Culture in 1993 investigated the main causes of school failure among migrant students from rural areas in the capital cities that received the largest share of migrants (Ministerio de Educación y Cultura, 1993). They found that 70% of the migrant children were a year behind in their studies, and from this group 70% was behind because they started school late. Moreover, 20% had temporarily abandoned school and 10% because of both reasons. This study considered both the internal and external reasons in schools that explain the high loves of desertion and dropout rates among migrant children. In this sense, they established that the migrant children drop out or start late in large measure because they come from homes of low socioeconomic status and live in houses located far away from their schools, among other factors.

A more recent study revealed significant differences in the educational outcomes between migrant and non-migrant children in El Alto (Vera et al., 2011). The study used matriculation data from the Ministry of Education collected in 2008 for initial, primary, and secondary education students. The authors compared measures of educational inequality between migrant and non-migrant students in all three levels. They found significant differences between these two groups in terms of three measures: (a) condition of grade repetition, (b) condition of *rezago* (age-appropriate grade entry), and (c) differences in years between the actual age and the normative age. They found that migrant students are more likely to repeat grades, enter grades past their due age, and do so by more years than non-migrant students. In La Paz, around 20% of the migrants came from rural areas. The net migration rate for students in El Alto was 39%, meaning that at least two fifths of the students who are enrolled in El Alto schools are migrants. Their figures show that 21% of the migrant students in El Alto entered a grade later in their lives than they were supposed to, compared to 14% of the no-migrant population. One fifth of migrants are, on average, 0.44 years behind. At the same time, 5% of the migrant students repeated a grade, compared to 3.8% of their non-migrant counterparts. These differences are greater at higher education levels. The data show that the probability of repeating a grade for migrants is significantly greater that for residents, even after controlling of student, home and school characteristics. Other findings include the fact that students who speak an Indigenous language at home are more likely to repeat grade. In their qualitative research, in which they interview students in the schools where migrants study, they find that migrant students have a difficult time adapting to a new place. There are also tensions among students, including discrimination against the migrant students.

Taken together, these studies indicate that the lack of access to educational opportunities remains a significant challenge for urban residents in the country's capital. They are also indicative of the challenges that many governments throughout Latin America face when it comes to providing quality education to Indigenous children and youth living in urban areas. Among the many strategies that are being tried to integrate urban populations more deeply, mass transit projects have recently received a great deal of attention.

Mass Transit Projects in Latin American Cities

Latin American cities have been home to many of the most progressive mass transit projects in recent decades. From Curitiba and Bogotá to Caracas, Rio and Medellin, many cities in the region have used mass transit with explicit goals of social integration, poverty and inequality reduction. Justin McGuirk (2014) in his book *Radical Cities* toured the region to describe how policymakers, architects, and urban planners have introduced or expanded mass transit to reach neighborhoods that have been historically marginalized, stigmatized, and generally excluded from the city. McGuirk wrote that "the barriers in segregated cities are not just social and psychological: they are marked as much by physical distances and journey times" (p. 166). He chronicled many large public housing projects that fell short of their utopian goals, but noted that some of the most effective urban policies in Latin America have been transport policies. “The answer to a divided city is integration,” he wrote describing the cable cars system in Caracas, “and there is no integration without transport connections” (p. 166).

What I find striking about some of the projects that McGuirk described is how many of the transit programs that were introduced had an educational mission. The title of his chapter on Bogotá even captured the connection he saw between urban planning and education: *Bogotá: The City as a School*. Yet nowhere has the connection between education and mass transit in particular been clearer than in Medellín. In the 1990s and 2000s, as local governments took more control over municipal finances and policymaking, and much of the violence around drug trafficking subsided, mayors and urban planners in both Bogotá and Medellin experimented with innovated programs to promote civic engagement and social integration. In Medellin, the mayor build a cable car line that connects the city center to Santo Domingo, a *comuna* (slum), located on of the hills that typically remains invisible to the middle class. Next to the cable car’s final station within Santo Domingo, the urban planners built a “library-park” and a new school.

The concept is to create open public spaces where children can feel safe to play and learn. I have not found any formal assessments of the educational impact of this “integrated urban project,” but McGuirk (2014) pointed to a survey in which commuters from Santo Domingo said they “would rather give up their mobile phones than the cable car” (p. 247). The impact of the project is also symbolic in that it sends a clear message about the priorities of the local government. It does something to counter the stigma associated with the *comunas*. McGuirk quoted Echeverri, one of the urban planners behind the project, as saying, “In a segregated city, where half of city doesn’t exist, it is necessary to connect not only in a physical way but in a mental” (p. 250).

Nevertheless, the symbolic power of mass transit can only go so far in addressing some of the most intractable urban problems. The Caracas *Metrocable* serves as a cautionary tale about the limits of social urbanism. The system opened in 2010 and was built by Dopperlmayr, the same Austrian areal lift company that built would later build the *Teleférico* in Bolivia. The cable car system significantly reduced the commute time from the Parque Central to a low-income neighborhood called San Agustin. The journey used to take 45 minutes on foot up hill; it now takes 5 minutes in the cable car system. At 50 cents per ticket, the Metrocable is also a quarter of the price of the bus. Close to the stations, the government is building amenities such as a vertical gym, a library or a community center. McGuirk noted several signs of real transformation. He quoted a resident of San Agustin as saying "The kids even dress differently now" (p. 168) and many homes around the stations have "For Sale" signs which indicated rising property values. Yet crime continues to be an unfortunate fact of life in Caracas, and the Metrocable stations are one more stage where that reality unfolds. Around the time that McGuirk visited Caracas, someone had been shot in one of the stations. Since then, Venezuela has been hit hard by inflation, low oil prices, and the worst recession in the country's recent memory. In that context, there is little that transportation can do to counter poverty and segregation.

In the context of Bolivia, rapid urbanization and motorization of the country's capital has led to increasingly more congested streets and constrained urban mobility. The population of the metropolitan area of La Paz has grown by 21% between 2000 and 2010, leading to higher congestion of traffic (Pando Solares Consultores, 2012). In response to this problem, the national government sought to modernize the capital's public transportation system. In 2014, the national government launched a cable car system to provide public transport to residents in both La Paz and El Alto. As of June 30, 2015, the first three cable car lines delivered over 24 million trips, according to *Mi Teleférico*, the state company that manages the service (Miranda, 2015). The company also sold over 20,000 student cards, which offer 50% discounts on ticket prices. As of 2015, the company had spent over 234 million dollars in the project and there are plans to expand the network to cover most of the city by 2017 (*Mi Teleférico*, 2015). Whether this system will deliver on its promise of greater social integration remains to be seen; this dissertation offers an approximation of its impact on families' decisions about schooling.

Conclusion

This chapter discussed the relationships among the residential segregation patterns in urban areas of Latin America and the ability of Indigenous children and youth to access quality education. Also discussed was the introduction of mass transit projects as common instruments of "social urbanism" aimed at integrating Latin American cities. I discussed existing literature on the impact of mass transit projects on education, with an eye to assessing whether they can counter the educational effects of residential segregation. In countries with large Indigenous populations living in cities, mass transit projects have the potential to have a long-term effect on the lives of Indigenous children and youth. While no prior study has specifically addressed this question, existing evidence from Mexico City and Colombia suggests that transportation policy has played an important role in improving the access of quality education for low-income students. In Bolivia, while the *Teleférico* is quickly becoming an important means of accessibility for urban dwellers, no prior research has assessed its impact on decisions about schooling. From a policy perspective, an important question to answer is whether the public subsidy on discounted cable car tickets for students has a positive impact on the degree of school segregation experienced by students. In the next section, I explain the research design that I used to estimate this relationship.

CHAPTER 4: RESEARCH DESIGN

The concept behind this study originated from the assumption that lower transportation costs would translate to greater disposable income for families; consequently, they would be willing to send their children farther away from home or enroll in higher quality schools that they could not previously afford. Since this assumption was developed before the fieldwork data were collected, this study was deductive and tested a preexisting theory about the way parents behave. Nevertheless, the study also needed to inductively uncover the most common concerns and challenges parents face to find a school and organize their children's commute to school. Therefore, I relied on both quantitative and qualitative research methods to assess whether mass transit counters the educational effects of residential segregation in the metropolitan area of La Paz-El Alto. In that sense, this study falls under the category of mixed methods in general (Small, 2011) and mixed-methods research on student mobility patterns in particular (Shay et al., 2016; Walker et al., 2009). Chapters 5-9 provide detailed explanations of the methodological choices I made, but this chapter gives an overview of my research design and data sources.

Research Goals

Table 2 summarizes the goals of the dissertation and their related objectives, tasks, products, and intended outcomes. The dissertation set out to answer three main research questions: (a) How extensive are residential segregation and school segregation in the metropolitan area of La Paz-El Alto? (b) Are there disparities in accessibility to educational opportunities between students of different socioeconomic backgrounds? And (c) Does mass transit reduce inequality of educational opportunity and school segregation?

The main challenge in answering these questions was to obtain an annual database that was comprehensive enough to capture the social composition of the student body in neighborhoods and schools of the metropolitan area of La Paz-El Alto. Moreover, the questions also require a set of commonly accepted measures and indicators to operationalize the concepts of segregation and accessibility, which can mean different things depending on the measure used. In addition, measuring the impact of mass transit on how students get to school and where they go to school lies is fraught with methodological questions about causality and challenges to identification.

Measuring Segregation

The literature on segregation has produced a plethora of indicators of segregation with advantages and disadvantages. The concept of segregation itself can take on different meanings, depending on the dimension of focus (Massey & Denton, 1988). Moreover, the choice of indicator can have a significant impact on the conclusions we can make about the extent of segregation (Allen & Vignoles, 2007; Murillo, 2016). Therefore, deciding which indicator to use involves both normative and technical judgments about what one intends to measure and about the appropriate properties of the chosen measure. I focus on the dimensions of evenness and exposure. Segregation as "unevenness" refers to the degree to which the distribution of students of different groups within spatial units differs from the distribution of those groups in the city. The indicator reduces the general concept (segregation) to specific dimension (unevenness or dissimilarity) in the distribution of two groups of people across space. The value of the index ranges from 0 for a complete integration to 1 for complete segregation. The value can be interpreted as the proportion of students from a given group who would need to switch neighborhoods or schools for the individuals of different groups to be evenly distributed. The index of dissimilarity meets a set of five criteria for good indices in the segregation literature: scale or composition invariance, symmetry in groups, principle of transfers, organizational equivalence, and symmetry between types (Allen & Vignoles, 2007). Moreover, the index is easy to interpret and offers the numerical equivalent to a segregation curve, akin to the Lorenz curve in the income inequality literature (Allen & Vignoles, 2007). The dissimilarity index also places the focus of analysis on the distribution of people across areas, regardless of the size of the groups in question. The index can serve as an indicator to compare levels of segregation across space and time because it is widely used in the segregation literature.

While the index of dissimilarity offers several advantages to other measures of unevenness, it is not free of problems and limitations. The index of dissimilarity can give a snapshot of the overall level of segregation in each context, as well as changes in the segregation level over time, but it cannot always be used to identify the source of change in segregation levels. For example, the index cannot separate out the change in segregation due to school choice as compared to processes that change overall eligibility of students of disadvantaged backgrounds (Allen & Vignoles, 2007). Moreover, the index of dissimilarity measures segregation based on two groups, while the social composition of neighborhoods and schools can be much more complex, particularly in a diverse, multi-ethnic societies like Bolivia’s. A few studies have shown also that the indicator is highly sensitive to small group (Carrington & Troske, 1997). The focus on evenness takes a normative standard and measures segregation against it; it does not say anything about other dimensions of segregation, such as the level of isolation or exposure that students experience. Despite these limitations, the index of dissimilarity remains the most practical and comparable measure. Moreover, I supplement this index of evenness with indices of exposure, which I describe in some detail in Chapter 6 along with the results.

Measuring Disparities in Accessibility

The transportation geography literature has produced several indicators of accessibility (Páez et al., 2012). In this literature, accessibility is generally conceptualized as the potential to reach spatially distributed opportunities such as employment, recreation, social interaction, among others. Accessibility is one of the main outputs of spatial development, the joint result of a transportation network and the geographical distribution of activities. However, the concept can be operationalized in many ways, ranging from simple counts of opportunities by neighborhood to complex "gravity models" that take characteristics of the individual into account. The indicators are further divided into normative and positivistic indictors; the former relate to the desired distribution of opportunities, while the latter seek to measure the actual distribution of opportunities (Páez et al., 2012). In other words, normative indicators measure accessibility relative to an ideal of how far it is reasonable to expect a person to travel to get to a service, while positivistic indicators consider how far people actually travel. Positivistic indicators allow for the measure of accessibility for different profiles based on wealth, ethnicity, age, gender, and so on (Páez, et al., 2010). To measure disparities in accessibility, scholars have used relative indicators that produce ratios between the accessibility scores of two groups of people.

I used the standard accessibility indicator in the literature and differentiated the scores by family's stated primary mode of transportation to school. The goal of Chapter 6 was to find out whether there are major disparities in accessibility to educational opportunities between students of different socioeconomic backgrounds. Is there evidence that students of different ethnic backgrounds or wealth status have different levels of accessibility to educational opportunities in the city? Are certain groups of students more disadvantaged than others in terms of how far they can travel to access educational opportunities? Answering these questions not only required a simple count of the number of opportunities that are available near the students' home, which is likely to reveal disparities, but it also necessitated a model that incorporates the students' ability to move in the city to access opportunities outside of their immediate surroundings. Chapter 6 presents the results for the analysis of relative accessibility to schools in the metropolitan area of El Alto-La Paz.

Measuring the Effects of Mass Transit

For Chapter 8, I used a reduced form model to estimate the impact of mass transit availability on how students get to school, where they go school, and the social composition of the schools they attend. The chapter explains in greater detail the model specification strategy that I used, but in a general sense I tried a combination of model specifications that attempted to isolate the causal impact of the introduction of the cable car system on a set of outcome variables. Because the cable car lines were introduced in some neighborhoods but not in others, I compared changes in student behavior over time in areas that were benefited by the system and areas that were not. Changes in student behavior over time in areas close and far from the cable car stations were assumed to be the result of the introduction of the cable car system. The main outcomes of interest pertained to student use of the cable car system and changes in their school choice induced by the cable car system.

The main challenge of identification in this natural experiment would be that students can non-randomly sort into treatment. However, I argue that the extent of sorting is small and that families have had little say over where the cable cars lines were built. The company that built the cable car system used a combination of geological, economic, and political considerations to decide where to build the cable car lines (Empresa Estatal de Transporte por Cable "*Mi Teleférico*" (EETC), 2014). Among those considerations are included the volume of trips that residents already made, the level of congestion, and the size of the benefited neighborhoods. Because the benefited areas are more populated and closer to the city center than other areas, one would expect that students living in those neighborhoods are different in expectation to students living in more peripheral areas of the city. For example, they might be more likely to switch schools because they have more schools available. I attempted to deal with this problem in two ways. First, rather than using a cross-sectional comparison of students near and far from cable car stations, I compared students in the same neighborhoods over time. I used two measures of the treatment. First, I used the continuous measure of distance to the closest cable car station as the treatment. If the cable car has no impact on student behavior, then the relationship between distance to a cable car station and the outcome variables should not change when the cable car lines are introduced. Second, I used a difference-in-differences model in which I compared neighborhoods that are equidistant to the center of La Paz, but differ in their distance to cable car stations. In both models, I assumed that parallel trends are controlled for by time-fixed effects so that the cable car availability has a causal interpretation.

Data Description

The data for this dissertation came from the Bolivian Ministry of Education's student matriculation records (RUDE, for its original name in Spanish, *Registro Único de Estudiantes*) from 2012-2015. At the beginning of every year, the Ministry collects matriculation cards for every student in the country to keep track of where students enroll in school and whether they complete the year and pass to the next level. *Figure 6* shows a sample of the form that school officials fill out for each student at the time of matriculation. The matriculation records include information about the student characteristics such as their socioeconomic background, age, gender, and ethnicity. The records also include data on students' primary mode of transport to school with options such as walking, minibus, bus, micro, and so on.

This RUDE database has three key advantages to other sources of information, though each one of these advantages comes with respective limitation. First, the dataset includes information for every student in the metropolitan area of La Paz-El Alto for every year from 2012 until 2015. The only other source of this scale would be the census, but that is not carried out every 10 years and does not match students to the schools they attend. On the flip side, unlike the census, the RUDE database does not have information about students who are not enrolled in schools, so we cannot keep track of students who exit the school system.

Second, the matriculation records about students' age, current and previous school, and matriculation status are strongly validated. At matriculation, parents are required to present their child's birth certificate as well as their matriculation card from their previous school. The Ministry of Education assigns an identification number to every student from the moment the student matriculates in a school for the first time. Because the unique identification numbers follow students over time, I tracked their progress over time, even if they switched schools. Schools can also verify the authentication of the matriculation records by pulling up student records in the Ministry's database using the unique student ID.

Nevertheless, while the matriculation records are cross-referenced and supported with documentation, the data on student background are not. School officials fill out the form in the presence of the parents who give their approval by signing the form. Yet there is room for error in the process. For example, parents are meant to present a receipt as proof of home address, but the school officials do not always verify that the address the parents provide is accurate.

Moreover, parents' answers about their assets at home, their primary mode of transport, and whether their child works or not cannot be verified.

In addition, the RUDE dataset contains geographic coordinates for every school in the country as well as detailed information about families' home addresses. The latter can be used to identify the neighborhoods where students live. Using polygons from the government of La Paz's research agency, I matched students' address to the geographic coordinates of the centroids of their neighborhood of residence. The process relied on an algorithm that assigned students to polygons with their pre-defined coordinates. The shortcoming of this approach is that neighborhoods vary significantly in size: the greater the area of a neighborhood, the greater the expected error in the assignment of coordinates for students' home address. Still, this method allowed me to assign coordinates to 90% of the students in the database for the metropolitan area of La Paz-El Alto. Even with a margin of error, a sample that covers almost 100% of the population carries significant statistical power.

Finally, the RUDE database has the unique advantage of containing students' unique identification number, which allowed me to match the matriculation records to data from the transit cards issued by *Mi Telérico*, the company that runs the cable car system. This database contains information about all the students who have been issued transit cards since the cable cars started functioning. The transit card gives students a 50% discount on every ticket. The limitation of this dataset was that I did not know how often the cardholders use the cable car system, when they started using it, or where they board and exist the system. At the very least, however, the transit cards allow me to use the transit card as a proxy measure for cable car use.

Qualitative Research

The quantitative research described above was supplemented by qualitative data gathered through interviews with parents about their experiences with residential and school segregation as well as their strategies for dealing with limited accessibility to educational opportunities. Commutating patterns can elucidate the social relationships and meanings of space in urban contexts (Pardue, 2010). These interviews gave me more insights about the ways in which mass transit availability influences students' educational experiences in metropolitan La Paz. The data collection process was divided in three phases. First, in a preliminary phase of exploration, I spent the summer of 2015 doing field research, interviewing officials in schools, the Ministry of Education, and the cable car company. At this point, no data were available for the year after the cable car line had been introduced. In the second phase of the field research, I interviewed families to understand the main challenges they face in accessing educational opportunities and the strategies they use to overcome them. This research took place in the summer of 2016. Meanwhile, in August of 2016, I obtained data for the matriculation year 2015, so I performed the quantitative analysis during the fall of 2016. Finally, in the winter of 2016, I used conclusions from the quantitative analysis to identify the schools that had been most affected by the cable car system. I conducted interviews with families who enrolled their children in those schools in 2017. I transcribed the interviews in Spanish, then translated and analyzed them for recurring themes.

The interviews were conducted using ethnographic research techniques of ethnosemantics (McCurdy, 2005). Generated in the late 1950s and 1960s, ethnosemantics was built on the idea that culture is learned, shared knowledge, much of it coded in language. Much of anthropological research is based on the study of the informants' language to discover the characteristics of culture. Ethnosemantics is one formal approach to this process, which relies on collecting the most important domains in an informants' speech, the relationships between those domains, and the attributes associated with each one of them. Based on detailed analysis of language, common themes emerge that say something deeper about the cultural norms and beliefs that influence people's behavior. In this study, I followed closely the procedures described in "The Cultural Experience: Ethnography in Complex Society" by David W. McCurdy, James P. Spradley and Dianna J. Shandy (2005). The results of these interviews are reported in Chapter 7, which focuses on the challenges of school accessibility, and Chapter 9, which explores differences between the experience of using the cable car system and other modes of transport in El Alto.

Methodological Limitations

Every study suffers from the limitations inherent in the positionality and subjectivity of the author. Rather than claim complete objectivity in my analysis, I tried to make explicit here the positionality and subjectivities that I brought to the analysis. Generally, I am motivated to describe the world as it is rather than the world as it should be; yet, I also believe that a world with equality of opportunity for students is a more just world than one where ethnicity determines socioeconomic status. When assessing the impact of mass transit on where students go to school, I am not motivated simply by an interest on how people respond to a price shock. I am motivated by the idea that mass transit might operate as an equalizing force, contributing to a more leveled urban opportunity space. Therefore, it is possible that I was primed to overstate the effect of mass transit on educational inequality. At the same time, my initial interest and focus on mass transit was based on the notion that a pre-existing theory should drive the research project and determine my questions. Had I pursued a purely qualitative research project, it is possible that I would have uncovered other themes that I did not pay attention to here.

In addition, my identity as a Bolivian mestizo with a privileged education in the United States gave me both affordances and constraints that could have influenced the results of the study. On one hand, I could access data that were highly inaccessible to the public. Employees at the government offices with whom I worked were open to collaborating with me because I came from a well-known American university. On the other hand, when doing interviews with parents on the streets and neighborhoods of La Paz and El Alto, it was difficult for me to build rapport with people I had never met before. People were constantly aware of my distinct accent; even though I am Bolivian, I grew up in the lowlands so I do not have a typical accent of someone from La Paz. These differences between myself and my informants probably influenced the nature of my results. To manage this limitation, I relied on one main informant who introduced me to her friends, yet the interviews with new people felt shorter and less detailed than the interviews with my main informant.

Moreover, this study was limited by the fact that the cable car system has only been active since 2014 so it has not been around for long. Other studies have analyzed the effects of mass transit over a timeframe of close to a decade (Colin Pescina, 2015; Combs, 2013). That was not possible in this study. Second, the dataset included data for students in the initial, primary, and secondary school levels only. While there are significant differences in the quality of schools across neighborhoods, most neighborhoods have a school or are close to a school. By contrast, universities are more concentrated in central locations. University students are currently using the cable car system more frequently. Out of the 20,000 transit card holders, only a third are students in regular education. Unfortunately, I did not have data for university students. My dataset included students in initial, primary and secondary schools only, which are demographic groups that are less likely to use motorized transport to get to school.

Finally, the study was also limited in the sense that it takes a narrow definition of segregation: the extent of “body mixing” that goes on in neighborhoods and schools. Even if mass transit can increase “body mixing” of students of different backgrounds who attend the same school, that tells us nothing about the quality of the contact among students once they occupy the same space. In this dissertation, I did not speak directly to the students to learn about their experiences in the schools that have seen the most significant social composition changes since the cable car lines were introduced. Nor did I collect data on their academic performance, which might have been affected by the access to higher quality schools, less travel time thanks to mass transit, or simply an easier commute with less stress and anxiety caused by congest traffic and the risk of robberies, accidents, or other forms of crime. Still, this study offers an initial step necessary to understand complex relationships between segregation, accessibility, and educational inequality.

CHAPTER 5: MAPPING SEGREGATION

Using standard indicators of segregation, this chapter measures residential and school segregation as experienced by students in the metropolitan area of La Paz-El Alto. The results showed that the metropolitan area of La Paz-El Alto exhibited high levels of segregation of students of different ethnic and socioeconomic backgrounds, comparable to some of the most segregated urban contexts in Latin America and beyond. The chapter begins with a summary of the statistics from the Ministry of Education's matriculation records. Then I describe in detail the indicators that I used to measure residential and school segregation. Next, I present the results using Indigenous students as the reference group and then students at the lowest and highest terciles of the wealth distribution as the reference groups. Finally, I compare the levels of segregation in neighborhoods and schools of La Paz-El Alto to segregation in the area in the past as well as segregation in other countries.

Summary Statistics by Municipality

Table 1 presents the matriculation data by ethnicity and socioeconomic status for the school year 2014. Diversity defines the ethnic composition of metropolitan La Paz-El Alto, which is home to students who self-identify as Aymara, Quechua, Mestizos, Afro-Bolivian, Guarani as well as many other Indigenous groups of the Eastern lowlands. The ethnic background data came from voluntary self-identification by parents at the time of matriculation. The data showed comparable and consistent statistics to the 2002 and 2010 censuses. Approximately 67% of the half a million students enrolled in schools of the metropolitan area of La Paz-El Alto identified with an Indigenous group. Close to 100% of them are Aymara students. Since other Indigenous students and Afro-Bolivian students made up less than 2% of the city's population, whenever I refer to Indigenous students, I am mostly referring to Aymara students. The data also showed that El Alto has a significantly larger share of Indigenous students than La Paz. More than 80% of students in El Alto are Aymara, compared to less than 40% in La Paz. Two thirds of the Aymara students in the metropolitan area live in El Alto, while two thirds of the Mestizo students live in La Paz. Of the 13,530 students who are enrolled in schools of Palca, Mecapaca and Achocalla, 96% are Aymara.

This initial snapshot of the metropolitan area also shows differences in student wealth across municipalities of the metropolitan area. Student wealth was calculated using an asset-based, composite factor that includes the availability of services such as piped water, electricity, sewage, Internet, and a nearby health care center, with an Eigenvalue of 0.99. These items were available in matriculation records. Because these variables represent basic services that families have access to depending on where they live, they can capture differences in wealth. Students who live closer to services are likely to live in homes with greater market value. The drawback of this measure is that it understates variation in wealth for students in the middle class or higher, which could be significant. *Figure 7* shows that the distribution of the raw scores of the student wealth index is skewed, with a long tail to the left. The scores do not capture variation in wealth among students who have access to all the basic services listed above.

Despite this limitation, the student wealth index raw scores can be broken down into three terciles to examine differences across students of various wealth levels. The results revealed structural inequalities in wealth across municipalities of the metropolitan area. El Alto has a higher proportion of students who are at the bottom tercile of the wealth distribution than La Paz. Only a quarter of students in La Paz are at the bottom tercile compared to almost half of the students in El Alto. Moreover, because El Alto has more students than La Paz, the clear majority of students in the lowest tercile of the wealth distribution are enrolled in schools of El

Alto. In fact, 66% of students in the bottom third tercile are enrolled in schools of El Alto, compared to 27% in schools of La Paz.

The contrast is even greater between students enrolled in schools of La Paz and those enrolled in schools of the municipalities of Palca, Achocalla and Mecapaca. Although these municipalities are being incorporated into the metropolitan area, they are farther away from the network of services available in La Paz and El Alto. They have 96% of their students at the lowest tercile of the wealth distribution. In addition, 7% of the students in the lowest tercile in the whole metropolitan area study in schools of those municipalities, even though students who live there only make up less than 3% of total student population. *Figure 8* shows raw scores of students' wealth across municipalities, which exhibit the same pattern: lower levels of student wealth in Palca, Mecapaca, and Achocacalla; a skewed wealth distribution in El Alto and La Paz; and greater mean wealth in La Paz than in El Alto.

Indicators of Segregation

To capture the level of residential and school segregation in the metropolitan area of La Paz-El Alto, I used standard indicators in the segregation literature (Allen & Vignoles, 2007).

Table 4 summarizes the results for three commonly used indices of segregation: the index of dissimilarity, the isolation index, and the interaction index. The index of dissimilarity measures the unevenness in the distribution of students of different groups across neighborhoods or schools within a geographical area of interest. I calculated the index for the metropolitan area of La Paz-El Alto with three pairs: Indigenous and non-Indigenous students; students at the lowest wealth tercile and everyone else; and students at the highest wealth tercile and everyone else. Regardless of the pair, the index of dissimilarity *D* for the metropolitan area can be given by:

$$D = \frac{1}{2}\sum_{i}\left|\frac{x_i}{X} - \frac{y_i}{Y}\right| \tag{4}$$

where *i* indexes the subareas of interest such as schools or neighborhoods; *x* and *y* are the number of students who belong to each group in a pair; and *X* and *Y* stand for the total number of students in each group in the metropolitan area. Segregation is smallest when the two groups in each pairing are evenly distributed. The index takes a value of 0 for complete integration and 1 for complete segregation (Allen & Vignoles, 2007; Iceland & Weinberg, 2002).

In addition, I estimated two indices of exposure: the isolation index and the interaction index. Exposure measures the degree of potential contact or the possibility of interaction between members of two groups (Iceland & Weinberg, 2002). Exposure depends on the extent to which members of two groups either share common residential areas or attend the same schools. Unlike the index of dissimilarity, measures of exposure do take the size of groups into account. The two kinds of indices are related, but they measure different dimensions of segregation. For instance, a small group of minority students who are evenly distributed across residential units of a city would yield a low score in the index of dissimilarity, indicating low levels of residential segregation. Nevertheless, the potential exposure of the members of the majority group to members of the minority group would be relatively low. Since no index is perfect, it makes more sense to use them together.

The basic and related measures of exposure are the indices of isolation and interaction (Iceland & Weinberg, 2002; Massey & Denton, 1988). The isolation index measures the probability that a person shares a unit area, either a neighborhood or a school, with members of the same group. The isolation index thus measures the potential exposure of members of the same group to one another. Conversely, the interaction index measures the probability that a person shares a unit area with members of a different group. In this way, the interaction index captures the potential exposure of members of one group to members of another. The two indices are given by the following formulas where *t* denotes the population of each unit area *i* such as neighborhoods or schools:

$$Isolation = \sum_{i=1}^{n} \left[\left(\frac{x_i}{X} \right) \left(\frac{x_i}{t_i} \right) \right] \tag{5}$$

$$Interaction = \sum_{i=1}^{n} \left[\left(\frac{x_i}{X} \right) \left(\frac{y_i}{t_i} \right) \right] \tag{6}$$

If there are only two groups, the isolation and interaction indices add up to 1, so higher values of isolation and lower values of interaction indicate higher segregation. I calculated the isolation and interaction indices for Indigenous and non-Indigenous students. I also estimated potential exposure between students at the bottom tercile of the wealth distribution and students at the highest tercile of the wealth distribution, and vice versa.

Ethnic Segregation

The first column in

Table 4 shows high levels of segregation based on the uneven distribution of students of different ethnic backgrounds across both neighborhoods and schools. The index of dissimilarity shows that 87% and 66% of the students would need to be reassigned to different neighborhoods and schools, respectively, for Indigenous and non-Indigenous students to be evenly distributed. Columns 2 and 3 show the estimates for La Paz and El Alto separately; based on these estimates, residential and school segregation as unevenness is less extensive within each municipality than in the metropolitan area. In La Paz, 57% of the students would need to be reassigned neighborhoods to attain an even distribution, while 66% of the students would need to be reassigned neighborhoods of El Alto. Similarly, school segregation is lower when calculated for each municipality. Only 60% of the students would need to switch schools in La Paz, and 57% in El Alto for Indigenous students to be evenly distributed within each municipality.

To make claims about how extensive residential and school segregation in La Paz-El Alto are today, it would be informative to compare these estimates to those of earlier studies of ethnic segregation in the area and to studies of other metropolitan areas. Unfortunately, to my knowledge, there are no prior studies of school segregation in metropolitan La Paz-El Alto. The studies that do exist have only examined residential segregation; because residential and school segregation are closely related, there is still value in comparing my estimates to those of earlier studies in La Paz and El Alto. Gray-Molina et al. (2002) estimated the levels of residential segregation for La Paz and El Alto using data from the 1992 census; they found scores of 0.23 and 0.22 for the two cities, respectively, using the same index of dissimilarity (p. 13). Using data from the 2001 census, Del Popolo et al. (2007) placed residential segregation between Indigenous and non-Indigenous people in La Paz at 0.30 (p. 26). These trends of unevenness would suggest that ethnic residential segregation has significantly increased since the early

1990s. Since 1992, the population of La Paz has grown partly due to rural-urban migration by Aymara citizens who settled in new neighborhoods. Between 1992 and 2001, La Paz and El Alto grew at an average annual rate of 1.1% and 5.1%, respectively (Gobierno Autónomo Municipal de La Paz, 2006). During the same period, La Paz grew from 713,000 to 790,000 residents, while El Alto grew from 405,000 to 657,000. This rapid urbanization increased the level of ethnic residential segregation, a pattern that probably persisted in the next decade.

Nevertheless, this comparison of segregation levels over time must be interpreted with caution. Definitions of ethnic identity, the size of the unit areas, and demographic changes can influence the results. Gray-Molina et al. (2002), for example, differentiated groups based on whether individuals were monolingual Spanish speakers or spoke an Indigenous language (monolingual or bilingual). Due to language loss, this definition of ethnic identity likely understated how large the Indigenous groups truly were in 1992. Moreover, the size of the areal units affected the calculation of residential segregation; while earlier studies used census data with areal units based on city blocks, I used referential zones that are larger than the census tracts. Finally, because of demographic differences by age group, ethnic segregation differs between students and adults, so my estimates using student data are not comparable to samples that relied on either survey or census data with adults.

These caveats aside, the metropolitan area of La Paz-El Alto appears to be one of the most residentially segregated urban centers in Latin America. The most recent review of the literature for Latin America shows that residential segregation for Indigenous peoples ranges from 0.06 for Montevideo to 0.46 for Sao Paulo on the index of dissimilarity (Comisión Económica para América Latina y el Caribe, 2014). The same report shows that metropolitan areas with the higher proportions of Indigenous people such as Quito and Mexico City had scores of 0.40 and 0.18, respectively. Del Popolo et al. (2007) placed residential segregation in La Paz at an intermediate level (0.30), Mexico City at the bottom as the least segregated city (0.15); and Asuncion as the most extremely segregated city (0.83). Del Popolo et al. (2007) did not provide estimates for La Paz and El Alto combined, even though the two municipalities are practically a single city. If these authors had combined La Paz and El Alto, their estimates would have been higher. If my estimates are correct, the level residential segregation of La Paz-El Alto today would be comparable to that of Asuncion in 2000, one of the highest in Latin America at the time. Residential segregation in La Paz-El Alto would also be comparable to the most racially segregated metropolitan areas of the United States. In 2000 the dissimilarity index of residential segregation between African Americans and Whites in large metropolitan areas of United States averaged 0.67, with Detroit, Milwaukee, and New York exhibiting the top three highest scores of 0.85, 0.82, and 0.81, respectively.

The measures of exposure paint a similar picture of residential and school segregation in metropolitan La Paz-El Alto. Indigenous students have a low probability of interacting with non-Indigenous students either in their neighborhoods or their schools; the probability of interaction is lower in El Alto than it is in La Paz (

Table 4). The average Indigenous student has a 33% chance of sharing a neighborhood with a non-Indigenous neighbor. In La Paz, the probability is 52%, while it is 16% in El Alto. In schools, the probability of interaction between Indigenous and non-Indigenous students is even lower. The average Indigenous student has an 18% chance of sharing a school with a non-Indigenous student. The average Indigenous student in La Paz has a 33% chance of sharing a school with a non-Indigenous student, but the probability of that happening in El Alto is 13%. Because these measures of exposure are sensitive to the size of the groups, they are neither comparable over time nor across cities. Yet they show low levels of interaction between Indigenous and non-Indigenous students in both neighborhoods and schools of metropolitan La Paz-El Alto.

Socioeconomic Segregation

Indigenous people in Bolivia and in Latin America are more likely to earn less and accumulate less wealth (Chiswick, Patrinos, & Hurst, 2000; Patrinos & Psacharopoulos, 1993; Psacharopoulos & Patrinos, 1994). Consequently, patterns of residential and school segregation based on ethnicity are closely associated with segregation based on wealth. Indeed, estimates of the index of dissimilarity based on the student wealth index show that students of different wealth backgrounds are highly segregated from one another in metropolitan La Paz-El Alto. Table 5 shows the results of my estimates of residential and school segregation based on two reference groups: students at the bottom tercile and students at the highest tercile of the wealth distribution. *Figure 10* and *Figure 11* present the same findings for students at the lowest wealth tercile, or low-wealth students, and students at highest wealth terciles, or high-wealth students.

The results show that both low-wealth and high-wealth students are more evenly distributed across neighborhoods of La Paz than neighborhoods of El Alto. The dissimilarity index shows that 72% of the low-wealth students and 52% of the high-wealth students would need to switch neighborhoods for students in each group to be evenly distributed. By contrast, in La Paz only 40% and 24% of the low-wealth and high-wealth students, respectively, would have to switch neighborhoods to attain an even distribution. Moreover, high-wealth students are more evenly distributed than low-wealth students, a pattern that suggests that low-wealth students are more segregated than high-wealth students are. The degree of unevenness for low-wealth students was 62%, while it only was 44% for high-wealth students in the metropolitan area of La Paz-El Alto.

The measures of exposure show a similar pattern of higher segregation for low-wealth students than high-wealth students. Low-wealth students are more likely to be isolated than high-wealth students. Low-wealth students have a 39% chance of sharing their neighborhood with a student of the same wealth level. By contrast, high-wealth students have a 32% chance of sharing a neighborhood with another high-wealth student. Similarly, low-wealth students are less likely to interact with high-wealth students than the other way around. The average low-wealth student has a 19% chance of sharing a neighborhood with a high-wealth student. By contrast, the average high-wealth student has a 27% chance of having a low-wealth student in the same neighborhood.

Columns 2 and 3 in Table 5 show important differences in social segregation based on exposure between La Paz and El Alto. In La Paz, low-wealth students are less likely to be isolated than high-wealth students, but they are almost twice as likely to be isolated than their high-wealth counterparts in El Alto. The average low-wealth student has a 31% chance of sharing a neighborhood with a peer of the same wealth background in La Paz; the probability of that happening in El Alto is 54%. By contrast, the probability of the high-wealth student sharing a neighborhood with another high-wealth student is 38% and 30% in La Paz and El Alto, respectively. Comparing levels of interaction between low- and high-wealth students in the two municipalities bears the same results. On the one hand, low-wealth students are less likely to interact with high-wealth students in El Alto than in La Paz. On the other hand, high-wealth students are more likely to interact with low-wealth students in El Alto than in La Paz. These asymmetries between the two municipalities are likely to be the product of differences in wealth between them: 44% of the students in El Alto belong to the bottom tercile of the wealth distribution, while only 27% of the students in La Paz do.

Turning our attention to schools, the results show high levels of segregation based on both the uneven distribution and the potential exposure of students of different wealth backgrounds. Table 5 shows that roughly half of the low- and high-wealth students would need to switch schools to achieve their even distribution across schools. The distribution is more uneven in El Alto than La Paz; however, there is almost no difference in the extent of segregation for low-wealth and high-wealth students in the two municipalities. The measures of exposure show a high degree of segregation as well. Both low-wealth and high-wealth students have a high probability of sharing a school with a member of the same wealth background. The average low-wealth student has a 61% chance of sharing a school with another low-wealth student; similarly, a high-wealth student has a 50% chance of sharing a school with a peer of the same wealth group. While these numbers might not seem very high, paired with the results for the interaction index, they reveal low levels of exposure between students of different socioeconomic backgrounds. Low-wealth students have a 15% chance of sharing school with a high-wealth student; similarly, the average high-wealth student only has a 20% chance of sharing school with a low-wealth student. These findings mean that, even with a long-tailed wealth index that understates wealth inequality, there are low levels of exposure between students of different wealth backgrounds in schools of La Paz-El Alto.

Maps of Segregation

Figure 12 shows that most of the students enrolled in schools of El Alto are Indigenous, while La Paz has several neighborhoods where at least 60% of the students are Indigenous. Moreover, consistent with the patterns revealed by earlier studies of residential segregation in La Paz (Del Popolo et al., 2007; Gray-Molina et al., 2002), a higher proportion of non-Indigenous students live in central neighborhoods as well as in southern La Paz. The bottom map shows that students at the lowest wealth tercile are distributed on the peripheries of the city. Differences in wealth between El Alto and La Paz are not as stark as differences in ethnic composition. This might be a product of the indicator used, as discussed above, because it is based on basic services available at home, so it misses variation between middle- and upper-class students.

Still, there is no question of a strong association between the ethnic composition and the level of wealth in each neighborhood. *Figure 13* presents a scatterplot of the share of Indigenous students and the share of students in the bottom wealth tercile in neighborhoods of metropolitan La Paz-El Alto. The share of Indigenous students who live in a neighborhood is inversely related to the share of low-wealth students in each neighborhood, which is consistent with the literature on income inequality and ethnic background in Latin America and in Bolivia (Hall & Patrinos, 2012; Psacharopoulos & Patrinos, 1994). Low-wealth students are clustered in neighborhoods with a high proportion of Indigenous students. Not a single neighborhood with a low proportion of Indigenous students has a high proportion of students in the lowest wealth tercile.

Figure 14 shows the same relationship within schools. In the top panel, we see that schools in which Indigenous students make up less than 10% of the student body have 13% of students from the lowest tercile of the wealth distribution. By contrast, 60% of the students in schools with more than 90% of Indigenous students come from the bottom tercile of wealth. The mean student wealth index shows a similar pattern. As the proportion of Indigenous students in schools increases, the mean student wealth declines. Moreover, the contrast in wealth is greater in El Alto than in La Paz. The bottom panel shows the proportion of students in bottom tercile across schools of different ethnic composition for each municipality. While the pattern is the same in both municipalities, schools in El Alto with at least 90% of Indigenous students have 60% of students at the bottom wealth tercile, while similar schools in La Paz have 32% of their students in the bottom wealth tercile.

Conclusion

This chapter has shown the high levels of residential and school segregation that students experience in the metropolitan area of La Paz-El Alto. Student populations of La Paz and El Alto are highly segregated based on ethnic and socioeconomic background. Because of the high correlation between ethnic background and wealth status, ethnic segregation of students in neighborhoods and schools is associated with segregation based on wealth. Neighborhoods and schools with a large share of Indigenous students tend to have students of relatively lower wealth status. These findings build on earlier studies of residential segregation in La Paz (Del Popolo et al., 2007; Gray-Molina et al., 2002) and in school segregation in Latin America (Bellei, 2013; Murillo, 2016b; Sabatini, 2006; Valenzuela et al., 2014). My estimates of residential segregation based on ethnicity in La Paz are higher than in earlier studies, and school segregation in the metropolitan area of La Paz-El Alto is comparable to the most segregated school systems in Latin America. In the next chapter, I analyze whether segregation is also associated with differences in accessibility to schools.

CHAPTER 6: SCHOOL ACCESSIBILITY

The goal of this chapter is measure disparities in school accessibility for students of different socioeconomic backgrounds. Significant differences exist in students' ability to reach schools; there is a spatial dimension to inequality of educational opportunity. Moreover, residential segregation is closely associated with inequalities of educational opportunity. Students who live in neighborhoods with a high proportion of Indigenous students or high proportion of low-wealth students enjoy lower levels of school accessibility. To make this case, the chapter defines school accessibility and describes common ways to measure it. It then discusses the relationship between residential segregation and disparities in school accessibility.

Measuring School Accessibility

One straightforward way to understand school accessibility is to view it simply as the supply of schools within an area. As discussed earlier, accessibility can be defined either from the point of view of the person or that of the destination. In this study, school accessibility is defined as the cumulative schooling opportunities available to students, constrained by the effort of travel from students' home to schools. Based on this definition, school accessibility is a function of two components: (a) the number of schools and (b) the cost of travel to get from home to each available school. Formally, in the transportation geography literature (Páez et al., 2010, 2012), school accessibility from a point of origin *i* would be defined as the following formula:

$$A_{ik}^{p} = \sum_{j} g(W_{jk}) f(c_{ij}^{p}) \tag{7}$$

Equation (7) captures the accessibility from a standpoint of origin location *i* (homes or neighborhoods) to opportunities *k* (schools) from the perspective of individual type *p* (students). This measure of accessibility is a function of the number *W* of opportunities *k* available at location *j* and the cost of moving from *i* to *j* as perceived or experienced by individual type *p*. The functions $g(\cdot)$ and $f(\cdot)$ take several forms in the accessibility literature, depending on the type of opportunity of interest and the assumed relationship between cost of travel and accessibility. The most straightforward form of $g(\cdot)$ would be a simple count of the number of schools, which can be adjusted by type of school to measure accessibility to schools of varying quality, for example. The function for cost of moving can also take several forms; the simplest form uses a threshold value of cost γ from the point origin *i* within which opportunities are treated as accessible.

$$I(c_{ij} \leq \gamma_i) = \begin{cases} 1 & if\ c_{ij} \leq \gamma_i \\ 0 & otherwise \end{cases} \tag{8}$$

In equation (8), the threshold γ can be a reasonable Euclidian distance, network path distance, travel time, or total cost of travel from *i* to *j*. Opportunities would be counted as "accessible" to a person in location *i* if they fall within a buffer zone constructed by the cost threshold. For example, if I use distance as the measure of cost, I can calculate the number of schools within 1000 meters of a student's home. Alternatively, I can use a sample of travelers and estimate the mean distance from *i* to *j* to produce a threshold that reflects travel behavior. The accessibility measure in equation (7) would be adjusted to:

$$A_{ik}^{p} = \sum_{j} W_{jk} I(d_{ij} \leq \hat{d}_i) \tag{9}$$

where $\hat{d}_i$ is the mean travel distance from home to school. However, this approach has a limitation that can be addressed with a threshold that accounts for differences in students' ability to move over space. The distance from home to school does not mean the same to a student with access to motorized transport and to a student without it. Moreover, in the context of metropolitan La Paz-El Alto, the geography varies significantly across space with implications for school accessibility. While El Alto has a flat surface, La Paz is in a valley with many hills, which would make it harder for students to get to school on foot. Therefore, it is important to use an approach that takes characteristics of different profiles of students into account and estimates different thresholds for each profile type (Páez et al., 2010, 2012). One way to vary the threshold by profile of student would be to calculate the predicted distance as a function of student and location characteristics. The relevant variables to include in the model depend on theoretical considerations. In general, the goal of the model of distance is to achieve the best fit possible. In this case, I specify the length of travel to school *d* (log-transformed to compress the long tail displayed in this variable) using the following model:

$$log(d_i) = \alpha + \beta X_i + dcbd_i + \sum_{m=1}^{4} \gamma_m M_{mi} + \varepsilon_i \tag{10}$$

In equation (10), *X* represents a vector of individual predictors, *dcbd* captures the distance from the students' home to the central business district, and *M* represents the municipality of the residence for each student. This model thus explains differences in the length of the journey from home to school as a function of sociodemographic factors and the location characteristics specific to each student. Based on the predicted values of trip length, I replace the grand mean of home to school distance in equation (9) with the predicted distance for different profiles of students, which are superscripted as *p*:

$$A_{ik}^{p} = \sum_{j} W_{jk} I\left(d_{ij} \leq \hat{d}_i^{p}\right) \tag{11}$$

Using this indicator, I can assess disparities in accessibility to schools for different profiles of students, which can aid in the planning of policy around where to locate schools or how to improve the transportation infrastructure to benefit specific students. For example, we can compare school accessibility for Indigenous students, in the lowest wealth tercile, who live in La Paz vs. students of the same ethnic and social background who live in El Alto. Moreover, I can create thresholds that vary depending on whether students travel on foot or by motorized transport. Since having access to motorized transport expands the potential reach of a student, accessibility to schools is greater for someone who has access to motorized transport compared to someone who does not. Following (Páez et al., 2010), I formally calculate relative deprivation in accessibility to schools using the following formula:

$$RADI_{ik}^{pq} = 1 - \frac{\sum_j W_{jk} I\left(d_{ij} \leq \hat{d}_i^p\right)}{\sum_j W_{jk} I\left(d_{ij} \leq \hat{d}_i^q\right)} \quad (12)$$

Equation (12) calculates the relative accessibility deprivation index from point of origin *i* to opportunities of type *k* (schools) as the ratio between the accessibility for student profile *p* and that of student profile *q*. For instance, let us assume that *p* stands for the profile of students without access to motorized transport and *q* stands for that of students with access to it. If the $RADI_{ik}^{pq} = 0.5$, half of the schools that are reachable with motorized transport are out of reach for students traveling to school on foot. Individuals of the type *p* are in a state of relative deprivation with respect to individuals of profile *q* from the perspective of the same location *i*. In the next section, I present estimates of school accessibility using the normative and positive approaches and the relative accessibility deprivation for two profiles of students.

Estimates of Travel Behavior

This section reports on my estimates of average trip length for different profiles of students based on matriculation records for the school year 2014. Table 6 shows the summary statistics for the sample of students who enrolled in schools of La Paz and El Alto at the initial, primary, and secondary levels. The sample excludes students for whom there are no records of home address, who made up less than 9% of the total. The summary shows that 74% of the sampled students stated that their primary mode of travel to school was walking. The most common mode of motorized transport is the minibus, which is consistent with recent research about mobility patterns in the area (GAMLP, 2015). Students who use micros and buses make up 6% of the total, while students who either use a private car or take a taxi make up less than 1%. Moreover, the summary statistics show that 69% of the students attend public schools, followed by private and mixed schools at 18% and 13%, respectively. Of the total number of students, 68% identify with Indigenous groups.

The dependent variable of interest is the trip length of students' commute to school. The coordinates of the centroid of the students' neighborhood serve as an approximation of the students' home. *Figure 15* shows the distribution of the distance from home to school by wealth (top) and ethnicity (bottom). The figure suggests important differences in mobility patterns by socioeconomic status. For instance, a smaller share of high-wealth students enrolled in schools located within 1 km of their homes than low-wealth students did. The opposite is true for students who enrolled between 1 and 6 km from home; high-wealth students have a greater share of their cases within this distance range than either student at lowest or middle wealth terciles. Lastly, the figure also shows that the distribution has a longer tail for low-wealth students, indicating that a greater proportion of students in this category travel more extreme distances than do students of higher socioeconomic status. Similarly, a higher proportion of Indigenous students enroll near their homes than non-Indigenous students do, while the opposite is true at more extreme distances.

Ultimately, these figures show that distance does not mean the same for students of different ethnic and socioeconomic backgrounds. Any measure of accessibility to educational opportunities needs to take these differences into account. To that end, Table 7 presents the results from my OLS estimates of equation (10). The model explains 17% of the variation in distance from home to school. Considering that I do not have coordinates for students' home address, nor do I have detailed travel diary data, I expected a low fraction of the variation to be account by my model. Nevertheless, we can see that including the students' primary mode of transport to school improves the fit of model significantly. We can also see that variables that are associated with socioeconomic status are strongly correlated with the length of students' trips to schools. Indigenous students, low-wealth students, students attending public schools, and students who live in El Alto are more likely to travel short distances in their commutes.

With these characteristics in mind, Table 8 identifies two profiles of students for estimating relative accessibility deprivation. The first profile is that of students who go to school on foot, while the second refers to those who go to school using a minibus. In both cases, the students are Indigenous, come from the lowest wealth tercile, and attend a public school. However, I further split the profile by municipality of residence to account for differences in geography, traffic levels, and general accessibility to transportation. The table shows the predicted values of school commute length for each one of the student profiles. Students who take minibuses to school are predicted to have a much wider potential reach. Moreover, students in La Paz were predicted to travel greater distances than students in El Alto, even when they come from the same ethnic and socioeconomic background and attend public schools.

School Accessibility

This section implements the estimated trip lengths to measure the levels of accessibility for students of different profiles. *Figure 16* shows the distribution of schools in metropolitan La Paz-El Alto and it displays a large concentration of schools in the center of La Paz. Schools are limited to areas such El Centro, Sopocachi, Miraflores and Ciudad Satélite. The geography of the city influences the distribution of schools. As the city grew toward its southeast edge, also known as the Zona Sur, several schools were built along the various river valleys. This is a product of the geological features of the city; lower areas, which are close to rivers, are more geologically stable than the steep hillsides next to rivers. Lower areas are typically settled first as well as the various establishments that serve residents of those areas, such as health centers and schools. Geology partly explains the urban form of La Paz with long neighborhoods that stretch from the old center out onto the peripheries of the city. By contrast, the distribution of schools in El Alto follow a more traditional concentric urban form. Unlike La Paz, El Alto has expanded over the flat territory of a highland plateau, so population density has increased on concentric arches, with the highest densities close to the center of La Paz and the lower densities as we move away from it. This pattern has left its mark on the distribution of schools. El Alto neighborhoods close to La Paz have more schools than more distant areas do.

Figure 17 shows the number of schools that are accessible within a threshold of 869 meters from the centroid of each neighborhood. This threshold is the mean commute length on foot, which we can interpret as the reasonable distance that the average student would travel to reach a school without any motorized transport. Using this threshold across the metropolitan area, the figure reveals significant spatial differences in school accessibility. The central neighborhoods of La Paz have the highest number of schools within reasonable walking distance. As we move away from the center, the number of schools drops sharply. Most neighborhoods around the periphery of the city have two or fewer schools. The bottom figure shows a similar pattern even when we account for student population size. The peripheral neighborhoods that have several schools per 1000 students are outliers; they are sparsely populated and have several schools within reach. The general pattern still holds: the central neighborhoods of La Paz have the highest number of schools per 1000 students, while areas away from the center have few schools per 1000 students.

Using a single threshold for the whole metropolitan area can overstate the level of accessibility that some students experience, while understating the accessibility of others. Students with access to motorized transport can potentially reach many more schools than students without it. *Figure 18* uses the predicted travel distances for the two profiles of students to calculate the cumulative educational opportunities from the centroid of each neighborhood. In the center of the city, a student can reach three times as many schools with a minibus compared to someone traveling on foot. *Figure 19* shows the results of the relative accessibility deprivation index ($RADI_{ik}^{pq}$). This index represents the number of schools out of reach on foot out of all schools which are reachable by minibus. Higher values indicate greater relative accessibility deprivation. The top panel shows the index for all schools; the bottom panel shows the index for public schools only. In both cases, students of the same socioeconomic background would face lower levels of accessibility without motorized transport.

School Quality

The spatial inequalities in wealth are also reflected in differences in the quality of schools that students attend. There are no official measures of school quality. The Ministry of Education does not evaluate schools on a yearly basis, nor does it provide any rankings based on student outcomes, student scores on standardized assessments, or other forms of school evaluation. Therefore, I created a school quality index with an Eigenvalue of 1.12 for 1,110 schools, based on variables that may reflect differences in school quality. Specifically, I created a composite factor for each school that combines three variables: the share of students who dropped out during the year; the share of students that finished the year but did not pass; and the share of students who are behind in school by two years or more. Since these variables capture negative attributes, I multiplied the composite factor by negative one to produce the school quality index. *Figure 20* shows how each one of the attributes as well as the school quality index are distributed across schools of different ethnic composition. Schools where 90% of the students or more are Indigenous score lower on the school quality index because they tend to have a higher share of students who are behind in school by two years or more. The opposite is true for schools where fewer than 10% of the students identify with an Indigenous group.

The top panel in *Figure 21* shows the distribution of the raw scores of this composite factor across the metropolitan area. Like the student wealth index, the skewed distribution of school quality scores is long-tailed to the left. Most schools have high promotion rates and low proportions of students who drop out, fail to pass the year, or fall behind by 2 years of more. The bottom panel shows the distribution of high quality public schools, which I define as those in the highest tercile of distribution of school quality scores. The overwhelming majority of neighborhoods away from the center have practically zero high quality public schools.

Ethnic Segregation and School Accessibility

While the mean school quality index does not differ significantly across municipalities, it does differ across schools based on the proportion of Indigenous students. *Figure 22* relates differences in accessibility to the ethnic composition of the neighborhoods where students reside. The data showed that the higher the proportion of Indigenous students in a neighborhood, the lower the number of schools available within walking distance; the pattern is true for schools of any kind. Residential segregation is closely associated with disparities in accessibility to educational opportunities. To formally test this hypothesis, Table 9 presents the coefficient estimates of a simple model that correlates the number of schools that are within walking distance and the proportion of students who are Indigenous, controlling for location characteristics. The constant is interpreted as the number of schools available in the city center, at zero distance from that neighborhood's centroid, and in the hypothetical scenario in which there were zero students residing there. The coefficients show that for each additional 10% of Indigenous students living in a neighborhood, the number of schools drops by 2 relative to the city center. Neighborhoods with 100% Indigenous students have 23 fewer schools than the city center, even after we control for differences in population size.

Table 10 shows estimates of the same model but for different kinds of schools. The implications are the same. A higher share of Indigenous students is associated with a lower level of school accessibility.

Conclusion

This chapter sought to measure disparities in school accessibility for students of different socioeconomic backgrounds. The results demonstrated that the level of accessibility varied significantly across space in metropolitan area of La Paz-El Alto. Therefore, significant differences exist in students' ability to reach educational opportunities. Disparities in school accessibility do exist and they tend to reflect patterns of residential segregation based on ethnic background. Students who live in neighborhoods with a high proportion of Indigenous students enjoy lower levels of school accessibility. The chapter also showed that access to motorized transportation sharply expands the number of schools that can be reached by students. However, whether improvements in access to motorized transportation translate to greater access to schools is a separate question, which I try to tackle in Chapter 8. In the next chapter, I present examples of how limited school accessibility affects the lived experience of parents in metropolitan La Paz-El Alto.

CHAPTER 7: A TALE OF TWO NEIGHBORHOODS

This chapter documents the experiences of families who have struggled to secure access for their children to schools in La Paz. I worked with a main informant to whom I refer with the pseudonym of Julia. The goal of my interviews with her and with the people she introduced to me was to identify the various challenges that families faced to find a school for their children and to organize their daily commute to school. This chapter offers an account of those interviews and the major themes that emerged. Because I met the interviewees through Julia, they are all parents of students who attend public schools in the Zona Sur, where she lives. Consequently, the results of these interviews are not generalizable to all families of La Paz. Nevertheless, they reveal important details about the ways families manage to enroll their children in schools. They also offer insights into how families organize their children's commute to school, making choices that balance their concerns for the cost of transport, convenience, and safety.

The Achumani Valley

Julia and I met for our first interview at the Center for the Family, where she used to work as an administrative assistant while pursuing her accounting degree. She now works for a real estate company in downtown La Paz, but she lives with her husband, her 9-year old daughter, and her mother-in-law in Achumani, one of the fastest growing neighborhoods in the Zona Sur region of La Paz. An Aymara woman, Julia was born in the area, but her parents migrated from the countryside to La Paz in the 1970s. Her dad was a property caretaker and her mother used to sell fruit and vegetables as a street vendor. We met through a common friend who has known her since she was in primary school. Looking back at her earliest memories of growing up in Achumani, Julia noted how much the area had changed since she was a child. "When I was little, the streets were all dirt roads, they weren't paved, and public transport would not reach past 22nd Street. We would walk from there to our place on 37th Street." Achumani grew substantially in the 2000s, as middle-class families built their homes there because of the more hospitable climate in the valley. Higher population density influenced where families send their children to school and the modes of transport they use to commute. Demand for high-quality schooling has risen significantly, making it more difficult for families to find available vacancies in their preferred schools.

Julia described a clear hierarchy of perceived quality of different kinds of schools. The *colegios particulares* (private schools) have the best reputations, but they are the least accessible due to high tuition fees. In her view, some of the best schools are private because they teach students to be *disciplinados* (disciplined), though a few private schools achieve that goal. Julia gave me a few examples of private schools where the teachers do not *mandan* (command) the students, but it is the other way around. Because the students pay tuition or their parents have high social status, the schools have a limited ability to discipline their students. In addition to private schools, the city has several *convenio* schools, which are private institutions that receive government subsidies so they can charge discounted tuition at least in one of their shifts. These schools charge full tuition for the morning shift, but only a reduced rate for the afternoon, even though the teachers and the facilities are the same. Thanks to her mother's employers, at some point Julia had an admission offer in La Salle, one of the oldest and most prestigious *convenio* schools in the city, but she turned the offer down. At the discounted rate of 35 bolivianos (5 USD) per month, Julia's family could not afford tuition at La Salle; they were struggling to pay her father's medical bills. Other *convenio* schools include the Domingo Savio schools and the Don Bosco schools, both of which are affiliated with the Catholic Church.

The *convenio* schools are still out of reach for many families, even though tuition is subsidized. Several *convenio* schools have rules that make it difficult for students to gain admission. Not only must students pass an admission exam, which is forbidden in public schools, but parents must also present proof of financial need to determine their eligibility for discounted tuition. Julia explained:

> In Domingo Savio there is a social worker. That's why you can't enroll your kid very fast. She visits your home to see if you have Cable TV and other amenities. If they see that you have money, they tell you that you can enroll them in the morning shift and pay the total of the monthly payment. They will not let you in the afternoon shift. If you have a school near your house, they reject you. If you have many children, they can tell you, "one can enroll in the morning and the other in the afternoon." You even must live close to Domingo Savio. A friend of mine enrolled her son, but she showed the electricity bill of her cousin's house to prove that she lived nearby. She showed a bill that did not correspond to her.

Julia enrolled in Julio Cesar Patiño School, one of the *colegios fiscales* (public schools) located in Calacoto, which is another neighborhood in the Zona Sur. More than two decades later, Julia faced similar constraints when she enrolled her daughter in school. Public schools continue to be the only option for her, but it was difficult to gain admission in one with a good reputation and accessible location. The Julio Cesar Patiño School has become one of the public schools in high demand. The school has a kindergarten of 95 students and primary school of 769 students. In addition, next to Julio Cesar Patiño lies the Rene Barrientos Ortuño High School, with a total of 1,163 students in the morning and afternoon shifts combined. To enroll her daughter in kindergarten, Julia had to wait in line for 2 months, taking turns with her husband to show up when the school administrators took attendance:

> We needed to be there at 6 a.m. in the morning, waiting. . . . They took roll call and we had to say "present" every day. If you weren't there, you would lose your spot in the line. For example, I was number 73, but then I started moving up to number 40 because other parents wouldn't come and they would lose their spots. In the afternoons, we would stand in line at 7 and they would take attendance again.

Once a student gains admission in kindergarten, the family does not need to wait in line again in the following years. The paperwork from the first-year transfers to the next one. By contrast, the parents of new students must wait in line to take the few open spots. The lines in primary school can be longer than in kindergarten; they can start as early as September, almost half a year before the school year starts. If after the long wait, more students seek enrollment than there are spots available, the parents' association holds a lottery. If a family gets a spot, they pay 100 bolivianos (15 USD) to the parents' association. The funds are used to purchase school equipment such as musical instruments, books, furniture, etc. Since the Ministry of Education and the Municipal government do not provide sufficient funds for facilities, these enrollment fees play an important role in funding improvements to the school.

The great majority of students who attend the Julio Cesar Patiño School rely on motorized public transport to travel to school. Using an asset-based metric, I found that 58% of the students came from families of low socioeconomic status and 36% of them came from low-medium socioeconomic status. In addition, 74% of the students are Aymara and 7% are Quechua. Only 3% of the students who study there live in Calacoto, more than a third live in Achumani, where Julia lives, and 8% come from as far away as El Alto. The mean travel distance for students is 3.8 kilometers, which explains why only 6% of the students walk to school. Of the students who use motorized transport, 67% use minibuses, 17% use micros, and 13% use buses, per the school's matriculation records. However, these statistics mask the many ways in which parents organize their children's commute.

Julia has lived in Achumani her whole life, so she can compare how she used to commute to Julio Cesar Patiño when she was little to the way her daughter does the same commute. While

Julia's parents allowed Julia to go to kindergarten practically on her own, Julia cannot imagine doing the same with her 9-year-old daughter today.

> My mother used to send me to kindergarten by myself in a *trufi*. She would pay the driver and then say, 'Would you let her off on such street?' Sometimes I would fall asleep in the car on my way back and the driver would wake me up. Children of my age would do the same; they traveled on their own. But now it is not possible because it is not safe anymore.

The *trufis* are taxi cars that operate in predetermined and fixed routes, picking up and dropping passengers as they go. They are cheaper than taxis, but they are more expensive than minibuses or micros, so she cannot afford their service. For a few years, Julia took her daughter to school in a minibus. Like most of the people I interviewed, Julia did not have good experiences in the minibus. In fact, in a recent survey on transportation, minibuses received the lowest ratings of any transportation mode even if most people use them on a daily basis (GAMLP, 2015). Julia's story was about the time her brother was robbed in a minibus.

> They did the *manchazo* (stain) to him. He was listening to his headphones with his cellphone in hand. People got on the minibus and sat next to him in Obrajes, many of them sat down next to him. One of them told him, "There is a big manchazo on your shoulder, young man, clean yourself!" He left his cell phone next to him and that was when one of them grabbed it and took it.

Julia cannot image using the minibus to send her daughter on her own. Nor would she send her in a *micro*, which are larger buses that charge the least. Again, they might be the cheapest option around, but Julia has safety concerns. She talked about the fact that micros can be uncomfortable when they are full. Because people come close to each other, men can take advantage of that and try to touch the girls. Julia experienced sexual harassment in the micros herself, which is why she no longer uses them to get around:

> During the peak hours, the micros are full of people. Sometimes people are hanging from the front door. It's not safe. They can take your cell phone; kids fall when the bus jumps; and there are older people who don't respect you. There are cases when they even touch you. I was fourteen when that happened to me. Because of that, I decided not to take the micro again unless it is empty.

Concerns for safety have hit new heights in recent years due to stories about kidnappings of children. For example, when I was in La Paz in July 2016, a story of the kidnapping of girl dominated the media for at least a week and thrust the risk of school kidnapping into the public conscience. The kidnapper picked up a girl from her school by claiming to be her babysitter. She had spent 2 hours at the girl's home on the day before, being interviewed by her parents for a babysitting job. That was enough time for the kidnapper to study the family and within 24 hours, she was texting the parents demanding 50,000 dollars in ransom. The family was pooling money together, while the police orchestrated an operation involving 350 police officers to comb the streets in El Alto. Following a tip, they found the girl inside a closet under the custody of the kidnapper and her brother. By the time the ordeal was over, the image of the girl had gone viral on the internet and the obvious question was "How did the school let that happen?" For parents, the second question to ask was "Could this happen to my kids?"

Since then incident, the government requires that every school install a security camera. "We have a security camera at my school now," affirmed Julia, who was particularly scared by the kidnapping since she has a daughter of the same age. "But there is no one watching over the camera. The camera records who comes in and who leaves, but there is no security guard standing at the door. It's just a TV. Sometimes, the teachers stand there to watch the kids, but not always." It is easy to see her anxiety about safety, which also extends to her concern for her daughter's commute. When she enrolled her daughter in kindergarten, Julia was responsible for taking her on a minibus, dropping her off in school and picking her up at the end of the day. She would pay a double fare each way. The high cost of transportation and the time commitment became a subject of disagreement between Julia and her husband.

> My husband used to tell me, "So far away you send her. She could walk to school nearby with her cousins. We should take her to the school right here." What happens is

> that very few husbands agree to do the sacrifice that it takes to send kids to the schools down below in the Zona Sur. Because of the costs and the time it takes to drop them off and pick them up. Especially in her first few years, there was no other way; there was no *gondola* (school bus) at the time. He would say, "Here close by would be easier." And I would insist that she would learn more in the Julio Cesar Patiño school. This past January, he finally told me that I was right; he noticed that our daughter is learning more than her cousins.

I wondered if other parents had a similar experience, so I asked Julia to introduce me to another family in the same school. She introduced me to Marta, a 40-year-old mother of two who met Julia while waiting in line to enroll her older son at the Julio Cesar Patiño School. To get to Marta's place, we waited over an hour in the main avenue of Achumani, but the minibus never came. We hitched a ride on a truck from one of the manufacturing companies that has a facility in Pantini, the neighborhood were Marta lives. The ride took 45 minutes of travel over a bumpy road that follows the Achumani River at the bottom of a valley with steep hillsides. We reached Marta's home, a one-story-high adobe house on the side of the main street. She was taking care of her 1-year-old baby while attending to the small store where she sells groceries to her neighbors. She has a 9-year-old son, who goes to Julio Cesar Patiño. She does not live with her son's dad anymore; she lives with her baby's father. Julia described Marta as someone who was *humilde* (humble) and did not have the opportunity to graduate from high school. She works hard to provide her children with the best education they can get.

"There is no minibus in this area," Marta explained, when we sat down for the interview. "I mean, there's one line, the line 376, but it takes a long time. What if the minibus doesn't ever show up? My son will be late to school." She sends her son to school in the *gondola* (school bus), which are private school buses that charge a monthly fee to take students to school, pick them up or both. The price of this service can be twice as high as the *minibus* or *micro* tickets, but families sometimes prefer *gondolas* because they pick students up at the school and drop them off slowly along the way. "It's 120 bolivianos per month and he takes it both ways," Marta added, when I asked her how much she paid. "I like it because it has a set schedule and it is safer. The minibus is complicated. We live far away and sometimes we must wait a long time to catch the minibus. It's not safe. The school bus is much better. We are not worried about our son missing the bus."

The parents' association at the Juan Patiño School regulates the transportation available to students. A few years ago, there were no *gondolas* serving the school, so a group of parents started offering rides to students using private minibuses. They now have over 20 minibuses, a couple of micros, and a few *trufi* cars, all of which operate like *gondolas*. Julia explained:

> The school now requires that *gondola* drivers be authorized by the municipality. They have to provide their personal data and paperwork; otherwise, they can't drive students. What happened was that any parent could be *gondolero* (school bus driver), but those parents sometimes made several kids sit on the same seat or they had them sit with their backs facing the driver, without a seatbelt.

Thus, the parents' association took steps to organize and formalize the school bus drivers. They added a control station that keeps track of the minibuses that come and leave and they fixed the prices in agreement with the drivers.

After the interview, Marta disclosed that she felt a bit nervous about her answers. She does not pay 130 bolivianos; she pays 140. She was nervous about it because the *gondola* driver told her not to tell anyone that he charged more than the fixed price. She did not denounce the driver to the parents' association because she was worried that he would not pick up her son. The trip from her home to the school is around 40 minutes on a minibus. The *gondola* is faster than the minibus and it is more reliable; the driver can avoid streets with many stoplights and can take a highway instead, especially during peak hours, taking the *gondola* can save the students several minutes of their day. For students like Marta's son, who live far away from the school and in isolated areas without alternative public transport, the *gondola* is the only viable option.

I asked her about her business and how she moves around to get supplies for her store. She gets many things delivered to her by friends and family. She also mentioned that her new spouse owns a pickup truck. We asked her whether her spouse ever takes her son to school. “No, he doesn’t,” she said, followed by a pause. “It’s because he is my son’s stepdad; not his dad.” Julia later explained that her friend had problems with her new spouse over her choice of school for her son.

> She doesn’t want to ask him to take the boy to school, because she doesn’t want to have to argue with him about it. It’s for her son that she is putting in twice the effort. He doesn’t have the feeling to take the boy to school. He doesn’t love him like a son. He tells her ‘why are you taking him so far to go to school? You should put him in the school right here [referring to the school in Pantini].

We asked Marta about the local school, which is technically rural because it is in Palca, a municipality that is adjacent to La Paz and is being gobbled up by the capital’s urban growth. Marta explained:

> It’s only ten minutes away on foot, but it’s not good. There’s no control. Sometimes they start school at nine-thirty. And even if I wanted to change my son to this school, it would be hard. He is enrolled in Calacoto since kindergarten, so it’s not easy to take him out now. It was a big sacrifice to enroll him there. I stood in line for a month, since there are not enough spots.

Julia intervened: “The school here is more rural. It’s now considered urban, but it is still like in the old community. Parents participate in old traditions and everyone participates in like in a community.” The word community, as in *comunidad*, can be translated as village or rural community. Without explicitly saying it, Julia was referring to Pantini’s ties to Indigenous tradition. “The parents *comparten* (spend time together) with alcoholic drinks in the graduation parties. Everyone shares a special dish and they eat like in the *campo* (countryside). In my school, that doesn’t happen. After the ceremony, people go home. When I was in my school, it was rare to see a dance. In my daughter’s school, never.” As we were wrapping up the conversation, it was not clear to me whether she meant that as a criticism of the school or not, but what was clear was that both Julia and Marta were convinced they had a better deal at Julio Cesar Patiño, even if they had to pay a high price for transport.

Chasquipampa

Chasquipampa is a neighborhood that has grown out of the Zona Sur. The name stands for "Land of Chasquis" in Aymara and used to be a resting point of the messengers who were responsible for carrying messages to different points of the Inca Empire (Saavedra, 2014). The current neighborhood was founded in the 1960s as a collection of farms with poultry and herds of dairy cows. The area did not have high population density until the 1980s, when migration from the countryside to the city began to intensify. Chasquipampa used to be the frontier of the city, but now is surrounded by newer neighborhoods. To the west, it borders with Cota Cota, to the north with Koqueni and Las Lomas, to the south with Rosales and to the east with Ovejuyo and Virgen de la Merced, all neighborhoods at the edge the La Paz.

Chasquipampa has been picked as one of the final destinations for the *PumaKatari* bus, the municipality's mass transit system. The name of the bus service comes from the Aymara words *puma* (Andean feline) and *katari* (serpent), which were totemic animals of significant cosmological meaning in the Tiawanaku civilization. The service was launched in February 2014 and since then has become the main mode of transportation for thousands of people in the city (LaPazBus, 2015). For people in Chasquipampa, the *PumaKatari* or Puma, for short, is cheaper, safer, and more comfortable than all other available modes of public transport. With Julia's help, I managed to meet several residents of Chasquipampa and its adjacent areas to chat about the schools they send their children to and how they organize their daily commutes to school.

Claudia lives in Chasquipampa, but we met her at the small kiosk where she sells dairy products in the Irpavi market. Her kiosk is 30 minutes away from her home. Five years ago, she enrolled her son in kindergarten at the Juan Herschel School, a public school located on 12th Street in Obrajes, another neighborhood in the Zona Sur where she used to live. When they moved to Chasquimpa, their boy stayed in the same school, even though his commute distance increased significantly. “When I enrolled him in Juan Herschel, I only needed to show his birth certificate and ID card,” she recalled. “But there are no spots for new students these days; you have to make a reservation and only if a vacancy opens up you can get in.” We talked about the schools in Chasquipampa, but she did not know much about them. She did explore schools in Calacoto and Irpavi, which are closer to her job, but she gave up looking when she factored in the challenge of gaining admission for her son. “I considered other schools when we moved, like Julio Cesar Patiño on 21th Street of Calacoto or the Rose Merry Galindo down the street here, but it wasn’t possible because most of the time, they ask that the student be *antiguo* (old) and it is too hard to get in.” Once a student is enrolled, the cost of switching schools is so high that parents tend to stick to their choices, regardless of how much their children would benefit from switching to a better school.

Claudia’s 10-year old boy goes to his old school in Obrajes by himself and then meets her after school at the market where she works. The boy can either take a minibus or a *PumaKatari* bus to school, which runs a line from Chasquipampa to the downtown of La Paz, passing by Obrajes, where his school is located. The route has stations and the buses go by at relatively fixed intervals but without a set schedule. The *PumaKatari* has a few advantages to the minibus service, but it also has its drawbacks. The most important benefit is the lower price; the main drawback is the wait time. As Claudia explained, “My son takes either the Puma or minibus, depending on how rushed he is. The Puma is a bit cheaper, only 1.5 bolivianos each way, but sometimes you wait longer at the stop. If I am in a hurry, I send him on a minibus for 2 bolivianos. They take roughly the same time to get there. . . . I just send him in whatever comes first." If a student's home and school are located near its stations, the Puma can be faster than the minibus as well. Claudia's son takes the Puma to school because his school is close to a station, but he takes a minibus to her mother's kiosk at the market because the Puma line did not go into Irpavi at the time of the interview.

Other interviewees were quick to recognize the advantages of the *PumaKatari* bus, but they have not been able to benefit from the system because the stations do not coincide with their destinations. We met Maria Luisa in Ovejuyo, which is next to Chasquipampa. She secured a spot in Julio Cesar Patiño for her son in first grade of primary school; the boy is now 10 years old. To Maria Luisa, making a trip to Juan Cesar Patiño can be a sacrifice, but she decided to enroll him there because in her view the education quality was superior to that of the local school in Ovejuyo. When talking about her preferences, she pointed out that the facilities are better in Patiño: "the school is clean and has fields." She also noted that the "teachers are good" and "teaching in Ovejuyo is not good enough. . . . Kids don't know how to read, but they pass to the next grade, and then again." She also expressed concern over the social life of students in her local school. "Sometimes the students also just spend their time drinking, and that doesn't happen as much in the *Zona Sur*. They drink, but not as much as in *Ovejuyo*." The question of control and safety came up as well in our conversation with Maria Luisa. She said that in the Patiño school, "They have a bit more control; they have police cameras, so we decided to risk it and take them there." But gaining admission into the Patiño school was not easy. Echoing the experience that Julia and Marta had, Maria Luisa also talked about the long lines.

> I wasn't here, I was in Argentina, but my father went to sleep outside to wait in line, first for kinder garden and then for first grade. Once they are in, it's easy, you just show up on the date they tell you and they are enrolled for the next year. There are very few open slots for new students. Say they have 5 total, then you would have to go to sleep,

> pay around 100 bolivianos per student, which is paid to the *junta escolar* (parents association) and the school administration doesn't get involved in that. I also considered other schools, but it is too hard. For example, I checked out Domingo Savio. They ask you to sign up a full year in advance. Then you wait in line. I also tried San Andrew's, but I couldn't do it.

Maria Luisa organized her children's commutes with the help of her husband, alternating between a minibus and a micro. One of her children goes to school in the morning; the other one goes in the afternoon. While she takes both of her children to school, sometimes her husband picks up her daughter after work. Since she does not have access to a *gondola*, the only way to get to school for them is by micro or minibus. The most challenging aspect of their commute is the return in the afternoons.

> We must wait for hours and hours. We sometimes walk all the way down to 15th Street to catch a minibus because the micro is too tight. Of course, the micro is cheaper, but it is not as safe as the minibus or *trufi*. Sometimes kids start to fall in the micro. It's not safe.

The Puma has become the safest alternative to any public transport mode, but it is not always convenient for families to use it. The Puma has several cameras that are constantly monitoring the passengers; two government employees manage the bus. The driver's sole job is to drive the bus, while a second person charges people to enter and makes sure people follow the rules of the bus. People sitting on certain seats are required to wear seatbelts, and food and drinks are strictly prohibited. In Maria Luisa's case, she would prefer to use the Puma. However, while the Puma station is close to her home, it stops far from the school so does not make sense for her to use it. In fact, Julia expressed the same sentiment when talking about the Puma.

> If the Puma came all the way to Achumani, and if it passed by daughter's school, I would send my daughter in it, or I would go with her and I would pay double ticket, because they have a preferential rate for children. In the minibus, I can't afford it because she has to pay a full rate for her own seat since she turned six years old. There's no discount like in the Puma.

After several interviews with Julia and people she knew, she explained to me how she is organizing her daughter's commute this year (2017). Instead of using the *gondola* services from the private companies at her school, she uses a *gondola chuta* (fake or counterfeit). One of her friends owns a taxi car and has two kids, so he takes Julia's daughter along with another girl from the area for a fee that is lower than what the school's *gondolas* would charge. She likes the friend's help because whenever she cannot be home to meet her daughter after school, she can always text her friend and tell him to drop her daughter off at her grandmother's place.

> The official *gondoleros* would hate me if I asked them to drop my daughter off wherever I want. They would want to drop her off somewhere on their own route, but she is too young to walk home from there. That's the advantage I have with my friend, even though he is charging us 120 Bs.

Julia explained to me that her friend has to be careful about not being caught by the official *gondola* drivers because sometimes they crack down on *gondoleros chutos*. The official *gondolero* drivers, those who are associated and affiliated with the school, are worried that the *chutos* are taking away their business. From the school's perspectives, the key concern is the safety of the students. *Gondola* drivers who do not follow the rules might take more students than they should, so parents complain to the school's administrators who then have to address their concerns with the *gondola* drivers.

Conclusion

The interviews with parents in Achumani and Chasquipampa revealed the many concerns that parents have when deciding where to send their children to school and how to organize their school commutes. Because of differences in the perceived quality of public schools, many parents make an extra effort to enroll their children in schools that are further from home, sometimes waiting in line for months and later incurring high transportation costs. Because schools do not have publicly funded school buses, parents must rely in a range of motorized modes of transport. In some areas, there is practically no access to many modes of transport, so families have come to rely on an informal sector of school buses that only recently has come under greater public scrutiny and regulation. Because the traditional modes of transport like minibuses or micros are not safe or comfortable, families expend a significant share of their income on private school buses. In this context, the mass transit system of the municipal government, the *PumaKatari*, has been a welcome addition to families' transportation options. In the next chapter, I focus specifically on an even bigger mass transit system, one that is set to transform the way people move around the city. In combination with the *PumaKatari*, the cable car system is set to develop an integrated, multimodal transit system. At this point, we can only see the small impact that it has had on school commute patterns and enrollment choices.

CHAPTER 8: EFFECTS OF MASS TRANSIT

Chapter 5 showed that neighborhoods and schools in metropolitan La Paz-El Alto are highly segregated along ethnic and socioeconomic class lines. Chapter 6 showed the variation in the school accessibility across the urban space is closely associated with the composition of the population in each neighborhood. Areas with a higher proportion of Indigenous students tend to have lower levels of school accessibility. The chapter also showed how motorized transportation would sharply increase school accessibility for students of disadvantaged backgrounds. Chapter 7 offered an example of how limited accessibility to schooling puts pressure on families to spend a greater share of their income on transportation. In this chapter, my goal was to assess whether mass transit expands educational opportunities. Specifically, I measured whether mass transit changes how students get to school, where they enroll in school, and the social composition of schools where they attend. Using a sample of students from El Alto, I calculated the change in the probability that students opt out of their local schools in El Alto to enroll in schools of La Paz after the mass transit system becomes available. I chose to focus on El Alto because a greater number of students from this municipality travel to La Paz than the other way around (see Table 11 and Table 12). Of all the destinations in La Paz, neighborhoods in the center of the city such Max Paredes, Centro, and Periferica are the top destinations for students from El Alto, though a significant share of the students travel all the way to the south of La Paz (Table 13). The results showed that the effect of mass transit is small, but statistically significant. Moreover, students at the lowest tercile of the wealth distribution are more likely than their counterparts to switch to a school in La Paz. Under certain assumptions, these changes can be attributed to the causal impact of mass transit on the choices that families make about where to send students to school.

Model Specification

Let *i* denote a student who lived in El Alto at times t and $t+1$. The outcome variable Y_{0t+1}^{is} takes a value of 1 if student *i* who lived a neighborhood s without mass transit at time t switched a school in La Paz at time $t+1$, and 0 otherwise. If Y_{1t+1}^{is} stands for a student *i* who enrolled in school when mass transit was available, then the causal effect of mass transit on the dependent variable would be given by:

$$Y_{1t+1}^{is} - Y_{0t+1}^{is} \tag{13}$$

In practice, we cannot observe the same individual in the two conditions: with or without mass transit access. Following Angrist and Pischke (2009), I estimated the *average* causal effect of mass transit availability on the outcome variable by looking at groups of individuals at different points in time and in two different spatial conditions. The heart of the difference-in-difference set up is an additive structure for potential outcomes in the non-treatment state. I assumed that:

$$E\left[Y_{0t+1}^{is} | s, t\right] = \gamma_s + \lambda_t, \tag{14}$$

where the expected value of the dependent variable, in this case whether a student from El Alto switches to a school in La Paz, is determined by a spatial variable *s* and a time variable t. In other words, this equation states that in the absence of mass transit, the dependent variable is determined by the sum of a time-invariant spatial effect and a time effect that is common across spatial units. The outcome variable for an individual *i* depends on the characteristics of the area where the student lived and the characteristics of year prior to enrollment. Therefore, the causal relation of interest would take following form:

$$E\left[Y_{1t+1}^{is} - Y_{0t+1}^{is} | s, t\right] \tag{15}$$

Let D_t^s be either a discrete or continuous treatment variable that captures mass transit availability in an area s at time t. As a discrete variable, D_t^s would equal to 1 if a cable car station is within a fixed radius from the students' neighborhood s at time t, and 0 otherwise. Defined as a continuous variable, D_t^s would simply be the distance between the centroid student's neighborhood s and the closest cable car station at time t. Assuming that the average causal effect of interest $E\left[Y_{1t+1}^{is} - Y_{0t+1}^{is} | s, t\right]$ is a constant, denoted δ, the observed outcome variable, Y_{1t+1}^{is}, can be written:

$$Y_{1t+1}^{is} = \gamma_s + \lambda_t + \delta D_t^s + \varepsilon_{t+1}^{is}, \tag{16}$$

where $E\left[\varepsilon_{0t+1}^{is} | s, t\right] = 0$. The interpretation of the coefficient δ varies depending on the kind of treatment specified, but conceptually we would have two potential outcomes: (a) the outcome for students living in areas *near* cable car stations *pre* and *post* treatment, and (b) the outcome for students in areas *away* from the cable car stations *pre* and *post* treatment. The first differences can be written as:

$$E\left[Y_{t+1}^{is} | s = near, t = post\right] - E\left[Y_{t+1}^{is} | s = near, t = pre\right] = \bar{Y}_{1,1} - \bar{Y}_{1,0} \tag{17}$$

and:

$$E\left[Y_{t+1}^{is} | s = away, t = post\right] - E\left[Y_{t+1}^{is} | s = away, t = pre\right] = \bar{Y}_{0,1} - \bar{Y}_{0,0} \tag{18}$$

Equation (17) captures the change in the outcome variable for students who lived in neighborhoods near the cable car stations before and after the cable car system became available in 2014. Equation (18) captures the difference in the outcome variable for students residing in neighborhoods located away from the cable car stations before and after the service was launched. The estimate of the causal effect of interest is the difference between these two differences, which can be expressed as:

$$\delta = \left(\bar{Y}_{1,1} - \bar{Y}_{1,0}\right) - \left(\bar{Y}_{0,1} - \bar{Y}_{0,0}\right) \tag{19}$$

The coefficient δ can be interpreted as the post-treatment comparison for students living near a cable car station minus the post-treatment comparison for students residing away from the service. To estimate this coefficient, the standard practice in the difference-in-difference methodology is to regress the outcome variable on the main effects of space and time predictors, and on their two-way interaction (Angrist & Pischke, 2009, 2015; Murnane & Willett, 2011).

Let *D* represent the natural logarithm of the distance between the centroid of the neighborhood where a student resides and the closest cable car station; and let *T* denote the years when students made enrollment decisions. The hypothesized regression model is:

$$\bar{Y}_{1t+1}^{is} = \alpha + \gamma D_s + \sum_{t=2012}^{2014} \lambda_t T_{ti} + \delta_1 (D_s \cdot T_{2013}) + \delta_2 (D_s \cdot T_{2014}) + \varepsilon_{t+1}^{is} \tag{20}$$

The interaction terms δ_1 and δ_2 would capture the difference in the slopes of the effect of distance on the outcome across different years. The cable car service became available in 2014, so the interaction term δ_2 would give us an estimate of equation (19), which is the average causal effect of mass transit availability on the probability that students in El Alto switch to schools of La Paz a year after the cable car was introduced.

The model assumes that neighborhoods in the years 2012 and 2013 and those in the year 2014 differ only in that the latter benefited from mass transit availability while the former did not. Events other than the rollout of the cable car system could have influenced the proportion of students from El Alto who enroll in La Paz schools. For example, during the year 2014, a bus transit system called *PumaKatari* was launched in La Paz, making it easier for people from peripheral neighborhoods to travel to the center of La Paz. Moreover, changes in overall demand for schooling in La Paz as well as differences in admissions policies could influence the proportion of students from El Alto who enroll in La Paz at any distance from the cable car station. The economy of El Alto has experienced a boon in recent years. Higher income levels are associated with higher demand for schooling. Moreover, at the same time, parents in schools of La Paz have reported that parents' associations are no longer allowed to charge fees to families. Both changes might induce a greater number of students from El Alto to enroll in schools of La Paz. The difference-in-difference methodology allowed me to difference out the effects of any parallel trends in the proportion of El Alto students who enroll in schools of La Paz over the same period.

The model also assumes that unobserved characteristics that could be relevant for the effect of mass transit on the outcome have the same distribution across neighborhoods and time periods. The expected value of the error term in equation (20) is equal to zero. However, this assumption would be violated if the treatment variable is correlated with the error term. There might be characteristics of the area where cable cars were introduced that are related to the proportion of El Alto students who enroll in La Paz. The construction of the cable cars was not randomly distributed over space. The government decided where to introduce cable cars based on the frequency of trips, population density, and other factors. Those factors could be related to the outcome variable. For example, since the first cable car stations were built at the border between El Alto and La Paz, for some students, living close to a cable car station also means living close to La Paz. I attempted to account for this threat to internal validity by using a second sample of students who live in neighborhoods of El Alto that share a contiguous border with La Paz. Then I separate the sample in two groups: those living in neighborhoods with mass transit and those living in neighborhoods without it.

Finally, the impact of mass transit might vary for different kinds of students. As was shown in the previous chapter, student mobility varies based on wealth and ethnic background. Indigenous students and students in the lowest wealth tercile generally travel shorter distances than their counterparts do to reach schools, mostly due to their lower access to motorized transport. On one hand, mass transit might lower the cost of motorized transport and induce low-income students to enroll in schools further from home. On the other hand, mass transit might be out of reach for low-income students for the same reasons that any motorized transport was out of reach for them in the first place (e.g., the transit tickets are too expensive, the opportunity cost of travel is too high, etc.). Therefore, the extent to which mass transit benefits the least advantaged students in society is an open empirical question. Following Muralidharan and Prakash (2013), I specified a triple differences model to compare the differential effect of mass transit on the outcome variable for students of different ethnic and socioeconomic backgrounds.

Introduction of the Mass Transit System

The Morales administration introduced the mass transit system in 2012. The construction began in full force in 2013; by March 2014, the Red line connecting the neighborhood 16 de Julio from El Alto with the old train station in the center of La Paz began its operations. The Yellow and Green lines began operations by December of that same year. Combined, the Yellow and Green lines connect Ciudad Satelite in El Alto to Irpavi in the south of La Paz. *Figure 23* shows all the planned and completed lines of the system. When complete, the system will cover more than 30,000 kilometers of travel distance. Each line has a capacity of 3,000 passengers per hour. Even if the system operates at one third of its full capacity, on any given day close to 90,000 people will be able to travel, which translates to a capacity of over 30 million trips per year.

Table 14 shows that cable car system offers cheaper transportation for some students depending on where they live and the existing transportation options they have available. The cable car moves relatively faster than other mobility options because it travels over homes and avoids the winding network path that cars normally take in La Paz. For instance, compared to a minibus, the Red line reduces the travel trajectory from its station of origin in El Alto to its final station in La Paz by 60%, which is associated with a 75% reduction in travel time relative to the minibus. The time savings are not as significant in the separate Yellow and Green lines. However, as a combined line, for someone who travels from one extreme of the line to another, the cable car reduces both travel time by 60%.

In addition to the time saved, the cable car system can also be a cheaper alternative to the minibus for longer distances. For students, the travel cost in the red line is 1.5 Bs. compared to higher rates in the minibus, which vary depending on distance. If a student were to travel from the Mirador station in Ciudad Satelite of El Alto to the Irpavi station in south La Paz, the cable car tickets would add up to 2.5 Bs. Doing the same journey in a minibus would be 6.60 Bs. Table 15 shows the share of families' income that is typically devoted to transportation costs. The data came from a recent study on intra-urban mobility conducted by Gobierno Autónomo Municipal de La Paz (2015). In the metropolitan region, families spend on average 102 Bs. per month on transportation, which makes up 13% of their total income.

There are important differences across municipalities and socioeconomic backgrounds. Families in El Alto spend 18% of their income on transportation, compared to 7% for families in La Paz. Low-income families spend 15% of their income on transportation compared to 9% for families at the highest income bracket. Low-income families in El Alto would spend 1 out every 5 Bs. on transportation. This means that any discount of the cost of transportation would have a greater impact on the disposable income of families who make relatively less money. To illustrate, *Figure 24* plots the changes in disposable income associated with changes in relative prices of transportation. The horizontal axis shows the percent change in transportation cost associated with changes in the price of transportation; a value of one indicates no change in price and a value of zero indicates transportation is 100% subsidized. The vertical axis shows the associated changes in disposable income, broken down by municipality (top) and income level in El Alto (bottom). For residents of El Alto, a 50% discount in transportation cost would be associated with an 11% increase in disposable income, almost four times as much as the equivalent change in disposable income for residents of La Paz. Low-income families in El Alto would see a 12% increase in their disposable income, compared to a 7% increase for high-income families in the same municipality.

Based on this back-of-the-envelope calculation, there are at least two reasons to suspect that mass transit has a different impact on residents of different income levels. On one hand, low-income families would see a greater change in their income due to lower fares. On the other hand, high-income families might also perceive a change in their income associated with the lower opportunity cost of travel. Therefore, the cable car system is likely to accrue benefits to those residents in either extreme of the income distribution, but a lesser impact to residents in the middle-income level. In the next section, I present the results of my estimates of the impact of the mass transit system on students who are residents of El Alto. I differentiate the impact by type of school and by socioeconomic background.

Summary Statistics

Table 16 shows the summary statistics for a sample of students who were residents of El Alto in years 2012-2015. The original dataset included 1.6 million observations of students enrolled in schools of the metropolitan area in the years 2012-2015. The records of each student in year *t* were matched with the records in year *t*+1 using their unique student identification number. Only 77% of the students re-enrolled at year *t*+1. The remaining observations included new students (14%), students who graduated (5%), and students who left the system either because they dropped out or emigrated (4%). Of the 1.3 million observations of students who re-enrolled, the dataset includes Universal Transverse Mercator (UTM) coordinates for 90% of the observations in La Paz and El Alto. The final sample includes 661,059 observations for students who were residents of El Alto in both time periods and re-enrolled in schools of La Paz or El Alto at time *t*+1. Students can be included three times in the sample if they enrolled in the system in all 4 years. In fact, roughly a third of the students appear in the sample three times. Lastly, the number of students increased by an annual rate of 6% over the course the three time periods. This growth rate would be consistent with the annual population growth rates of El Alto of 5.1% and 3.1% for the inter-census periods 1992-2001 and 2001-2012, respectively (Instituto Nacional de Estadística, 2015).

The outcome variable of interest takes a binary form that equals 1 if a student studied in a school of El Alto at year *t* and then switched to a school of La Paz at time *t*+1. In addition, I also include a dummy variable for students who hold transit cards from the cable car company *Mi Teleférico*. These records do not include any information about the extent of use of the system by each student. They only indicate that a given student registered with the company to get a card that gives them a 50% discount on every ride. Some students might be using the system to go to school without the card; others might have card but use it occasionally for non-school-related purposes; yet others might have the card because they were enrolled in La Paz before the cable car became available. In any case, even if I do not observe cable car usage directly, I can safely assume that if a student holds the card, he would be more likely to use the cable car system to commute to school than otherwise.

The continuous treatment variable is the distance in meters from the centroid of students' neighborhoods to the closest location of a cable car station. The mean distance was 5,333 meters, with a range from 82 to 13,521 meters. The distribution of distance values is skewed to the right, with a skewness score of 0.30. To normalize the distribution of this variable, I used the natural logarithm of the distance to the cable car station. Other studies on the impact of transit policies typically define the area of incidence of an intervention as a buffer zones around a station (Colin Pescina, 2015; Combs, 2013). Nevertheless, studies of urban mobility patterns have revealed that families engage in complex, multimodal, and multipurpose trips. In the context of El Alto, the average trip is partitioned in at least three different sections, involving changes in mode of transport (GAMLP, 2015, p.41). Therefore, I preferred a continuous treatment to avoid selecting an arbitrary cut-off point at which the cable car system is no longer available to El Alto residents. *Figure 25* shows the distribution of the two outcome variables by distance to the closest cable car station. Students who live far away from the cable car station are less likely to hold a student car. Similarly, the proportion of students who switch to schools in La Paz decreases significantly with respect to distance to the closest cable car station. In the timeframe of 2014-2015, the proportion of students who switched to schools of La Paz increased across the board.

The dataset also included individual and school-level controls. Close to 82% of the students in the sample identify with an Indigenous group. Socioeconomic background is determined using an asset-based, composite factor that includes the availability of services such as piped water, electricity, sewage, Internet, and a nearby health care center, with an Eigenvalue of 0.99. The score ranges from 1 to 3 with a mean value of 1.86. Additional individual level predictors include gender, whether a student has a motor disability, the age of the student, and whether the student is behind in school by 2 years or more. The school-level predictors represent the differences in the characteristics of the schools in which students enrolled at time *t* and the schools in which they enrolled at time *t*+1. Discrete choice models with two alternatives typically include the differences in the attributes of the relevant alternatives. I cannot observe directly the alternatives that students or their families considered before enrollment. I assumed that the best guess of the relevant alternative is the school where students were enrolled at time *t*. The school-level controls are the differences in school quality, share of Indigenous students, mean student wealth, and student body size between students' old (time t) and new schools (time *t*+1). The characteristics of the schools were constructed using data from the year *t* to avoid bad controls. The school quality indicator constitutes the share of students who are behind by 2 years or more and the proportion of students who passed the year.

Main Results

Table 17 shows the coefficient estimates first for the probability of holding a student card. *Figure 26* captures the predicted values for the coefficient of interest—the effect of distance from the cable car station on hold a transit card. A student who lived next to a cable car station in 2014 had an 8% chance of holding a student card, compared to a 2% chance for a student living approximately 1 kilometer away. In addition, Table 18 shows the effect of mass transit on the probability that students switch to schools of La Paz once mass transit becomes available. For students living next to the cable station, the probability more than doubled from less than 2% to more than 4%. The effect of distance on the probability of switching also changed after the cable car system was introduced. At the same time, the slope of the line for the transition period 2014-2015 in *Figure 27* is steeper than the slopes of the lines for the earlier transition periods. Each additional log unit of distance is associated with a 0.2% reduction in the likelihood that a student switches to a school in La Paz. After the cable car system was introduced, the impact of each log unit of distance on switching increased by 0.3%. Table 19 shows that the effect of mass transit is greater for public schools than it is for either mixed or private schools. The effect on mixed schools is so small that it is not statistically significant at the 90% confidence level.

Effects of Mass Transit by Student Background

Table 20 and Table 21 show the effect of mass transit on holding a transit card by ethnicity and wealth, respectively. First, Indigenous students are less likely to hold a transit card regardless of where they live in El Alto. Non-Indigenous students who live next to the cable car station have an 18% chance of holding a transit card. By contrast, only 8% of the sampled Indigenous students who live near a station hold a transit card. Second, distance to the cable car station is negatively correlated with students' holding a transit card. However, the size of the coefficient differs by ethnicity. Each additional log unit of distance is associated with a 2% drop in the likelihood that the average non-Indigenous student holds a transit card, compared to only 1% for Indigenous students. This finding suggests that non-Indigenous students are more likely to use the cable car system than Indigenous students are.

Similarly, Table 21 shows that students in the lowest tercile of the wealth distribution, or low-wealth students, are less likely to hold a transit card than students at the highest tercile of the wealth distribution, or high-wealth students. Close to 20% of the high-wealth students who live near a cable car station hold a transit card, compared to less than 9% of the low-wealth students. Noticeably, only 6.4% of the students who are in the middle of the wealth distribution hold a student car. This observation again suggests that students in the lowest and highest ends of the wealth distribution are more likely to benefit from the cable car. *Figure 28* illustrates the point by plotting the predicted probabilities of holding a transit card against distance from the nearest cable car station by wealth. Both the intercepts and the slopes of the lines for high- and low-wealth students are greater than they are for middle-wealth students.

Student background also appears to interact with the impact of mass transit on the probability of switching to schools of La Paz. The results in Table 22 show that Indigenous students are less likely than their non-Indigenous counterparts to switch to schools in La Paz in the period 2012-2013. In subsequent time periods, the probability of switching increased for Indigenous students, though the change is not significantly different from zero at the 90% confidence level. The triple interaction term captures the differential effect that distance to the cable car station has for Indigenous students compared to non-Indigenous students. Distance to the cable car station has a smaller effect for non-Indigenous students than for Indigenous students when the cable car becomes available. However, the size of the difference is small and statistically insignificant at the 90% confidence level.

Table 23 shows the results of the triple interaction between distance to the cable car station, time, and wealth status. The probability of switching to a school of La Paz does not differ significantly across different wealth levels in the years prior to mass transit availability. After the cable car system is introduced, the proportion of students who switched to schools of La Paz increases more for low-wealth students than for any other group. For low-wealth students who live next to the cable car station, the probability of switching to schools of La Paz increases from 1.5% to 6.4% when the car system becomes available. By contrast, the year in which the cable car was introduced is associated with a relatively smaller change for students of higher socioeconomic status. Put another way, in 2014-2015, low-wealth students were more than twice as likely as high-wealth students to switch to schools in La Paz.

Since this change in the intercept might be the product of factors other than the introduction of cable car system, we can only have a causal interpretation of changes associated with distance to a cable car station. What we see here is that once the cable cars start operating, the distance to a cable car station has a greater effect for low-wealth students than for students in either the middle or the highest wealth terciles of the wealth distribution. In 2012-2013, a low-wealth student who lived next to a cable car station was 4.6 times as likely to switch to La Paz as a student of the same wealth profile who lives 3 kilometers away. By contrast, in 2014-2015, a low-wealth student living next to the cable car station was 4.85 times as likely to switch as a student of the same wealth status who lived 3 kilometers away. That is a small, yet statistically significant difference of 0.25 in the odds of switching to schools in La Paz.

Robustness Checks

One threat to internal validity in the model is that students can sort themselves into treatment, which could lead me to overstate the size of the impact of mass transit. On average, around 8% of the students moved neighborhoods each year; consequently, at least some of the changes in the outcome variables might be related to residential sorting. Students who move closer to the cable car system might differ from other families in ways that are correlated with their probability of enrolling in schools of La Paz. They could be induced to switch to a school in La Paz, regardless of whether the cable car is available. While I cannot rule out this possibility, I tried to control the bias in two ways. First, I ran the main model with a dummy that took the value of 1 for movers and 0 otherwise as the outcome variable. A significant increase in the number of movers after the cable car was introduced would suggest that families are sorting into neighborhoods with easier access to the cable cars. In fact, the opposite was true. The share of movers dropped over time and the effect of distance to the cable car station on the probability of moving is positive when the cable cars become available, the opposite of what would indicate evidence of sorting into treatment Table 24. Second, I ran the main model excluding the students who moved. If movers were causing a bias in the coefficient of the main predictor, removing them from the sample should precipitate a drop in the effect of mass transit availability on the outcome variable. Table 25 shows removing the students who switched neighborhoods does not alter the main results.

Moreover, the findings provide evidence of a pre-trend before the cable car system was fully introduced. In the transition period 2013-2014, distance to the cable car station had a greater effect on the probability of switching from schools of El Alto to schools in La Paz than in the previous year. Since the cable cars were not operating until 2014, we should observe no difference between the effect of distance to a cable car station on switching schools in 2012 and the effect of distance in 2013. The model, however, showed that the pre-trend is significant. This means that students were more likely to switch schools to La Paz if they lived closer to La Paz in the transition period 2013-2014. One possible explanation for this pre-trend might be anticipation. The cable car system was announced in 2012 and construction started in 2013. Parents reported that they enrolled their children in schools before the year started knowing that would soon be able to send their children to school on the cable car system.

An alternative explanation might be that there were other changes that took place over time that influenced the impact of distance on the probability of switching to schools of La Paz. The cable car stations were built on the border between La Paz and El Alto. Distance to the cable car station is essentially the same as distance to La Paz. Unobservable, time-varying changes that are mediated by distance from the students' homes to La Paz would bias the main coefficient. For example, changes in gas prices would change the travel cost from El Alto to La Paz, thereby influencing the impact of distance to La Paz on the outcome variable. To address this problem, I ran the main model with a separate sample of only students who live in neighborhoods that share a contiguous border with La Paz. Of these students, the treatment group is made up of students whose homes are located near the cable car station; the control group consists of students whose neighborhoods are away from the stations, even though they are close to La Paz.

Table 26 shows the summary statistics for this sub-sample and Table 27-30 show the estimates of the model. Again, the results do not provide enough evidence to reject the null hypothesis that mass transit availability has no impact on where students go to school. Students who lived in treated neighborhoods were more likely to enroll in schools of La Paz; yet the difference is small, and students are more likely to switch to public schools than either private or mixed schools (Table 27). *Table 28* shows that students in the lowest wealth tercile were more likely to switch to schools in La Paz when mass transit became available. *Table 29* shows that Indigenous students in this sample were less likely to switch to schools in La Paz when mass transit was available, but the result was only significant at the 90% confidence interval. Once controls were added, the coefficient was no longer statistically significant.

If the mass transit system induced the families from El Alto to switch to schools in La Paz, we would be able to see this effect in changes in the composition of the student body of schools next to the cable car stations in La Paz. Specifically, out of all the students who are enrolled in schools of La Paz, the proportion of students who come from El Alto should increase because of the lower cost of transport. This change would be greater in schools that are close to stations than in schools that are far away. *Figure 32* shows that in schools located more than 300 meters away from a station, the share of students who come from El Alto has hovered around 4.4%. By contrast, schools that are located within 300 meters of a station saw an average of around 5.5% in their share of El Alto residents in 2015, the first year when the cable car was available. *Figure 33* shows an even greater increase for public schools. Table 30 more formally presents coefficient estimates for a simple model of the proportion of students enrolled in schools of La Paz who come from El Alto. Overall, the share of students who come from El Alto remains low, even for schools near cable car stations. However, public schools tend to have more students from El Alto, and when the cable car station is available, they see a 7% increase in the share of students who come from El Alto relative to mixed or private schools.

Finally, I ran the main model using a different dependent variable to test whether mass transit availability had an impact on where students go to school. Table 31 shows the result of the main model with the dependent variable being the difference in the distance from the students' neighborhood to their school at times t and t+1. If the difference is positive, then a student moved from a school that was relatively close to home to a school farther away from home. Most students in the sample did not switch schools, but there were a few students who switched to schools closer to home and other who switched to schools further away from home. If mass transit availability increases the probability that students will switch to schools that are farther away from home, we should see an inverse correlation between the distance to a cable car station and the difference in distance to school. A student who lives far away from a cable car station would be less likely to show a positive change in the distance to school than a student who lives close. The results in Table 31 suggest that the introduction of the cable cars increases the distance between home and school for students who live closer to the cable car stations.

Conclusion

In this chapter, I used a difference-in-differences framework to measure the effects of mass transit on the probability that students who live in El Alto enroll in schools of La Paz. Taken together, the findings did not provide enough evidence to reject the null hypothesis that mass transit has had no effect on where students of El Alto enroll in school. Overall, I can say that the size of the effect has been small, but statistically significant. Mass transit availability has been associated with a greater number of students from El Alto switching to schools of La Paz. However, the impact has not been the same for all kinds of students. Students in the lowest tercile of the wealth distribution were more likely to switch schools after the cable car lines were introduced. This finding was consistent with the hypothesis that the income elasticity of the demand for either transportation or schooling is greater for individuals who have relatively lower incomes. Low-income families tend to spend a greater proportion of their income on transportation than higher-income families do. Therefore, if mass transit reduces the cost of transportation, low-income families might experience an increase in their disposable income, which could induce them to tradeoff the proximity of a school in El Alto for the perceived advantages of a school in La Paz. The mechanism through which this happens cannot be directly observed with the data that I have available; nor can I know the different ways in which families deal with the challenge of low school accessibility in El Alto. I take up these questions in the next chapter through qualitative research based on a series of interviews with parents in El Alto.

CHAPTER 9: CALVARY WITHOUT TRANSIT

In the previous chapter, I used quantitative research methods to measure the impact of the cable car system on where families send their children to school. While the effect size is small, the chapter showed that the cable cars system has made it easier for some families to reach schools in La Paz. In this chapter, I present accounts based on interviews that I conducted with parents who are using the cable car system to organize their children's school commutes. I also present quotes from parents who do not use the cable cars, even though they either live near the cable car stations or enrolled their children in schools near the stations. These accounts revealed the many ways in which the cable cars are influencing families' experiences of the urban spaces. For some, the cable cars have become essential to their daily lives, while for others they have had no real impact on how they organize their commutes. One of the main advantages of the cable cars over other modes of transport has been the greater level of security. Parents in El Alto fear the possibility of accidents, robberies, or kidnappings. In addition, they describe the cable cars as being faster, more comfortable and often cheaper than the alternative mode of transit.

Ciudad Satélite

Ciudad Satélite is one of the oldest and largest neighborhoods of El Alto. The name carries the double meaning of being located on the periphery of La Paz as a "satellite" neighborhood in relation to the city center. The second meaning is tied to the neighborhood's landmark telecommunications towers, which are visible from almost anywhere in La Paz. The neighborhood was founded in 1966 as a collection of several planned urban housing projects called CONAVI, with the first plan being Plan 561, followed by plans 175, 405, and 266 and so on. At first, the area had no access to public transportation, but people would take *rapiditos,* which were quick rides in cars by neighbors who had access to them. Others simply walked down and up the steep hillsides to get to the city center in La Paz and back. A crowed public transport sector emerged since with larger buses and the proliferation of minibuses in the 1990s. I selected this neighborhood to conduct interviews because in 2014 it became the home of the cable car station *El Mirador*, where the yellow cable car line begins in El Alto. While not all residents who live in the area use the cable car system, talking to parents here gave me a window into the schooling options students have and the extent to which the cable car system had impact on their lives.

Juan is a mechanic in his 70s who lives in Plan 561, one of the several CONAVI developments in Ciudad Satélite. He has three granddaughters who are still in school. He talked about the challenges of enrolling them in the schools that are closer to his home. "Available schools? There are none. To the contrary, they are all full," he said bluntly while working on an engine he was fixing. "We should have more schools in the area, so our children can complete their studies. Most youth and children have to go down to the city to study," he added. When he talked about the "city," Juan was referring to La Paz. El Alto is now bigger than La Paz, and it enjoys official status as its own city with a municipal government; yet many people still talk about La Paz as being the city as opposed to El Alto. Regardless of the term used, Juan would not be the only person to perceive schools in La Paz to be of higher quality than those of El Alto.

Moreover, many parents in El Alto reported they had trouble in securing a spot for their children in the local schools of El Alto. The largest school nearby is Donoso Torres, and it is also the oldest and most prestigious public school in the area. Yet the vacancies in this school are all taken and many families are unable to secure enrollment for their children. Juan's granddaughters have had to find a school outside of their neighborhood because they could not find a spot in any of the local schools. Comparing the schools in his area to the one where his granddaughters study, Juan said that the main difference was not the quality of the schools, since they are all public schools with similar teachers.

> The most problematic difference for us is the distance. We have to travel from one neighborhood to another, and traffic is chaotic. It takes us forty-five minutes, more or less, in my calculation, because I have to take a vehicle from Satélite to Ceja and another vehicle to Juan Pablo Segundo. If we are late, we can spend eight bolivianos each way. We normally take the minibus, but sometimes due to emergencies or other reasons, we have to take a radio taxi. On the way back, we are not in a hurry anymore so we never take taxis.

Unlike La Paz, traffic in El Alto flows on large avenues that stretch from La Ceja intersection out of the city toward other urban centers. In between those avenues, a dense web of streets provides the basic network where homes and businesses are located. Anybody who must go through La Ceja would experience congested traffic due to the high number of minibuses and micros that stop to pick up and drop off passengers traveling to and from La Paz. The street vendors who occupy much of the street space also contribute to the slow flow of traffic in La Ceja. For Juan's family to decide to enroll the granddaughters on the other side of La Ceja, the local schools must truly have been hard to get in.

For other families, the reason to opt out of local schools in Ciudad Satélite was perceived quality. Natalia has a fourth-grade boy who attends a private school called Instituto Americano, which offers bilingual education in Spanish and English in the afternoons and is in Sopocachi, one of the oldest and most affluent neighborhoods in La Paz. She enrolled him there for kindergarten. She explained that there are available public schools in her area, "but the truth is that the education is not very good and that is why many of us choose to take our children to private schools in the city." Again, notice how she referred to La Paz as "the city." Pressed to elaborate on what she meant, she noted that "the *avances* (progress) in the subjects within public schools or even the private ones here in El Alto are not the same as those in the city; they are more ahead over there in their *enseñanza* (teaching/learning)." As an example, she noted that even at his age, her son is being "taught concept maps, does group work and has to know how to interrelate with others, that is, they are teaching him for the future because in the university they will use that kind of study." To organize her boy's commute to school, Natalia originally used the cable car system but eventually she decided to use the school's *gondola* service.

> Until last year, because of the age of my little one, I use to take him down in the *Teleférico* (cable bar) and up in micro; then, I would go down in *Teleférico* again to pick him up and would go up once again in micro. Now I send him in the school's gondola, which is more expensive by around thirty bolivianos because I pay two hundred twenty bolivianos for the school bus. I used to spend one hundred ninety bolivianos with the *Teleférico*, but I waste too much time. For thirty bolivianos, I can work more and do more things. In the *Teleférico* it would take me thirty-five minutes; I would have to walk three blocks, more or less. Now, in the school bus, he takes about twenty-five minutes on the way down and thirty-five on the way up because it is a steep hill.

The cable car system has also come to suffer from problems of success. During rush hours, right before schools start at 8 a.m. in the morning, the cable car stations have long lines of people waiting to use the service. Each cable car holds up to 10 people; during rush hours, they are all full. While they are large enough to be comfortable, the long wait in the morning contributed to Natalia opting for the school bus. She said, "I used to go down *tranquila* (relaxed), but now whenever I go down to pick him up to figure out what his grades are or for other reasons, the *Teleférico* is really full. I must wait in a tremendous line. Until last year, it wasn't like this, but now the *Teleférico* is super full." Moreover, Natalia liked the fact that a *gondola* driver offers door-to-door service and she saves a lot of time by not having to go all the way to the school with her son or to run errands.

> The driver is also in charge of picking him up from the school itself, from his classroom, he picks him up, he brings me reports, say, he brings pictures of the date when there will be a test, or if I have to pay a fee, with the driver I send what I can't take down to the school, and that is the advantage. In the end, time is money. On top of investing time in going down, I am also losing money because I would only have a couple of hours to work and to do other things. Now I just wait for him fifteen minutes *tranquila* (calm/relaxed) before the gondola arrives.

I also collected interviews with residents of Ciudad Satélite who were enrolling their children in Gregorio Reynolds, which is a private school located a few blocks away from the Cotahuma station of the Yellow Line. Marcos, one of the fathers who was standing in line to submit his paperwork for matriculation, explained that the schools in Ciudad Satélite are all full, so he looked for a school that was easier for him to matriculate his son, who is about to enroll in first grade. Since he missed the chance to matriculate his son earlier, he now competes with many more children for fewer openings in the schools near his home. "The matriculation here was easy," he said, after submitting his paperwork. "I just did a quick consultation and they helped me immediately. I had all the pre-requisites in hand, like a copy of his school card, his birth certificate, copies of my ID. . . . I also had to pay two hundred sixty Bs. for the first month of tuition." When asked how he would organize his son's commute to school, he quickly answered: "He will use the *Teleférico*. It's faster." In his view, the main difference between the cable car and the *gondola* was travel time. He estimated that the trip would be around 10 minutes from Ciudad Satélite, while the *gondola* would be around 30 minutes each way.

Another parent in the same school echoed the same sentiment, but also explained that she would save money with the cable car and travel more comfortably. "We arrive here in twenty minutes from our place in Satélite. I pay three Bs, both ways it is six. And my kids pay 1.50 each. If we were to take *trufi*, we would pay 3.5 per person for adults and children each way." In addition, she described the experience of taking the cable car as being more pleasant than any of the other services.

> If you go early, between seven and seven-thirty a.m., there's a long line; you have to stand in there for a long time, but then the trip is shorter and more comfortable. It's a lot faster and you don't have to *discutir* (argue) with the drivers (laughter) because one always argues with the drivers of the minibuses.

Asked if she knew more people who used the cable car to take their kids to school, she said, "Yes, there are many people in Satélite that come down to this school in the *Teleférico*. The thing is that schools over there are not very good, they don't have a good curriculum and there are no good teachers." Matriculation data from 2015 appeared to support this claim.

Figure 34 shows that until 2014, no more than eight students from El Alto studied in Gregorio Reynolds, making up less than 1% of the student body. In 2015, the number of students from El Alto more than doubled to 23 or 2.5% of the total. I could not get data for 2016, but the parents I interviewed thought the number has increased even more.

Parents in the school located near the Irpavi station, which is the last station on Green Line, made similar comments about why they decided to use the cable car system. For many of them, however, the cable car is only one among many other options at their disposal. They enrolled their children in the Unidad Educativa del Ejercito La Paz, which is affiliated with the military and offers preferential admission of the children of military families. Nevertheless, the school also admits non-military families and the tuition is significantly lower than in other private schools. The parents I talked to did not attribute their decision to enroll their children in that school to the availability of the cable car. Instead, they talked about the quality of the school: "It's a very prestigious school and kids learn to be disciplined like in the military." Asked to describe how she organized her daughter's commute, she explained that her dad, who is an architect, takes her to school in his car, but she comes back home on her own using the cable car. Her daughter is 12 years old, so she felt comfortable letting her ride the cable car on her own. "The *Teleférico* is safe, I am not worried. It takes longer to come back, but I know at what time she is supposed to be here." Other parents in the same school talked about the cable car being clean, safe, fast, and more reliable than the minibus. For people in El Alto who do not have a private car, the cable car has become the easiest way to travel to school. Yet students from El Alto still make a small fraction of the student body in this school, even if their number doubled from 2014 to 2015, as shown in Figure 35.

Villa 16 de Julio

The Red Line has benefited families who live in Villa 16 de Julio in El Alto, a busy business area that is famous for the weekly street fair that stretches for many blocks and attracts people from all over the city to shop. One of the interviewees who lives there talked about the ways in which the cable car changed the quality of life of her older son:

> Her takes the Teleférico to go down to his university and pays 1.50 bolivianos each way. . . . He used to get home at eleven p.m., but now with the *Teleférico* he gets here a lot faster, always around eight p.m. and by nine p.m. at the latest. . . .

Unlike in the case of the Yellow and Green Lines, the Red Line is clearly a cheaper and faster alternative to the families who live in Villa 16 de Julio. This relates to the fact that the main alternative to it is to travel down the Autopista, a highway that meanders its way down into the center of the city where traffic accumulates and slows down. Moreover, people who live in Villa 16 de Julio have to either go to La Ceja to catch a minibus or take steps down from El Alto and board on a minibus off the Autopista highway. As has become clear by now, families see the minibus as the most uncomfortable mode of transport. Aside from being at the mercy of the drivers, who can hike up the price depending on demand, people who take the minibus often have to fight for a seat, so older children and students often suffer from being pushed around.

> I thought it was just a story that we would have cable cars until I saw it and for me it has been great help in the first year. My son once got home at eleven-thirty p.m. because he couldn't catch transportation. Now he gets here early and he feels safer. . . . It's also cheaper. He saves one boliviano going down and up as well, and he comes back faster too and he doesn't have to be pushing older people to be able to catch transportation. He is very polite and doesn't want to push people.

Her son has come to depend on the cable cars so much that he struggles when the company must fix the lines and stops the cable cars from functioning. "On those days, he says that his *calvario* (Calvary) begins. I tell him it is only five days." She cannot wait for the Blue Line to start functioning. At the time of the interview, the Blue Line was under construction and it has been completed as of this writing. “My younger one walks to school because his school is nearby and there is no *movilidad* (vehicle) that can take me directly from here to his school. We are waiting for the new line to open because it would be a big help.” The line will connect her neighborhood to the school of medicine in Miraflores or the *Universidad Pública de El Alto* (Public University of El Alto—UPEA), which her younger son is considering for his university studies. “I will get him a student card to use the cable cars just like I did for my older son,” she said as she talked about her future.

Another one of the interviewees, a man in his 30s, lives near the school Integración in El Alto, but he sends his child to the Kinder Simona Manzaneda, which is in San Pedro in La Paz. He takes his child in his own *movilidad* (vehicle), but what was interesting was that he said he uses the cable cars during emergencies, whenever there are strikes or blockades on the streets. Comparing his private car to other vehicles, he said that “minibuses are uncomfortable and sometimes they don’t come or you have to push other people to catch one; that’s why I prefer my private vehicle. They are no good when there are *bloqueos* on the streets; sometimes they are the ones blocking the streets to get higher rates.” This was a common theme for families who send their children to schools in the center of La Paz. The blockades are a common occurrence in the streets of both El Alto and La Paz. Using data from the national institute of statistics, Pando Solares Consultores (2012) estimated that in 2009 and 2010 there were approximately five marches or blockades per day, excluding weekends. In addition, during weekends and sometimes in the weekdays as well, festivals and celebrations are carried out on the streets which slow down traffic. In those instances, the cable car becomes the preferred mode to get in and out of the center for anyone in Villa 16 de Julio or even beyond.

The cable car system seeks to address the problem of discrimination by the minibus drivers. Minibus drivers make more money if they load and unload people quickly; they also make more money if they fill up their seats with as many paying passengers as possible. Therefore, they often refuse to pick up families with many children because they would take too long to get on the minibus. They sometimes do not stop for older people either. If a parent is carrying a bag of goods to go to work and to take her child with her, minibus drivers would refuse to pick them up. In fact, in a survey conducted in 2011 with a sample of close to 2,000 people, 78% of the respondents stated that at some point they had been discriminated by the minibus drivers (Pando Solares Consultores, 2012). Residents of Villa 16 de Julio also complained about the fact that the minibus drivers often charge more at night or they divide up a trip in parts and charge more for each part, which is called *trameaje*. Combined with the discomfort of traveling in the tight space of the minibus, these attributes of the conduct of the drivers themselves makes this mode of transport one of the least appealing. The cable car, by contrast, has explicit rules against discrimination and offers preferential treatment to children, the old, and people with disabilities.

Conclusion

This chapter reported on interviews with several families who have used the cable car system to organize their children's commute to school. Their accounts offer more detailed insights into the ways they view the cable car system compared to other modes of transportation. In general, the cable car has been described as faster, cheaper, more comfortable, reliable, and convenient than other modes of transport. However, whether families enjoy one or multiple of these benefits depends largely on their situation, the location of their homes in relation to the station, the location of schools, and their perceptions of the relative quality of local schools versus schools in La Paz. In other words, there as many cases as there are people, and a general trend that applies to all is unlikely to emerge. What I can say is that for those who do use the cable car regularly, the long list of benefits cannot be reduced to monetary savings. The quality of life improves when people can avoid the busy and congested streets of La Ceja; their situation improves when they can avoid being blocked by protests or marches; their days are a bit easier when they do not have to push others to get a seat on a minibus; or when parents know they can expect their children to get home at a reliable, consistent, and reasonable hour. What cannot be captured in these interviews is whether the experience of students within the schools they attend is any better than it would have been with mass transit. That is one among many of the limitations of this study, which I discuss in the next chapter, along with policy implications and questions for future research.

CHAPTER 10: CONCLUSIONS

This dissertation set out to explore the impact of mass transit on the relationship between residential segregation, transportation policy, and educational equity in the metropolitan area of La Paz-El Alto. Does mass transit counter the educational effects of residential segregation? The main questions that guided my research were: (a) How extensive are residential segregation and school segregation in the metropolitan area of La Paz-El Alto? (b) Are there disparities in school accessibility based on the ethnic and socioeconomic composition of neighborhoods? and (c) Does mass transit increase school accessibility and reduce school segregation? Using a combination of quantitative and qualitative research methods, I found that students in La Paz-El Alto are highly segregated by ethnic and socioeconomic background; neighborhoods with high proportions of Indigenous students tend to have lower levels of accessibility; and the introduction of the cable-car system has broadened schooling options for students and reduced school segregation. Specifically, mass transit availability has increased the probability that students who live in El Alto enroll in schools of La Paz, changing the composition of the student body in La Paz schools by increasing the share of students who come from El Alto. Nevertheless, the size of the effect has been small due to factors other than transportation policy that influence where students go to school, such as admission policies, limited vacancies in public schools, family income, and preferences for different kinds of schools. Moreover, students of higher socioeconomic status are more likely to use the cable car systems; however, students of lower socioeconomic status are more likely to switch schools when the cable car becomes available. In this chapter, I summarize the evidence that supports these conclusions, discuss how the findings relate and contribute to existing scholarship, explore policy implications, and identify questions for future research.

Key Findings

How extensive are residential segregation and school segregation?

Using several segregation indices, I showed that students in La Paz-El Alto are highly segregated based on their ethnic and socioeconomic background. The results showed an uneven distribution of Indigenous and non-Indigenous students as well as low- and high-wealth students across neighborhoods. I estimated residential segregation of Indigenous and non-Indigenous students in La Paz-El Alto to be 0.87 in the Duncan Dissimilarity Index. The most recent estimates of residential segregation of Indigenous and non-Indigenous peoples in Latin American cities show Duncan Dissimilarity Index scores ranging from 0.15 in Mexico City to 0.83 in Asunción, Paraguay (Del Popolo et al., 2007). The level of residential segregation in La Paz-El Alto today would much higher than in La Paz in 2000 (0.30) and comparable to that of Asunción in 2000 (0.83), which was the most segregated city in Latin America at the time. Residential segregation in La Paz-El Alto would also be comparable to the most racially segregated metropolitan areas of the United States. In 2000, the Duncan Dissimilarity Index of residential segregation between African Americans and Whites in metropolitan areas of the United States averaged 0.67, with Detroit, Milwaukee, and New York exhibiting the top three scores of 0.85, 0.82, and 0.81, respectively (Massey, 2001).

Moreover, the results showed evidence that the ethnic and socioeconomic composition of neighborhoods is highly correlated. Neighborhoods with a higher proportion of Indigenous students tend to have a higher share of students from the lowest third of the wealth distribution. Studies on income inequality based on ethnic background in Latin America have documented the fact that Indigenous peoples on average earn less and accumulate less wealth than non-Indigenous people (Chiswick et al., 2000; Patrinos & Psacharopoulos, 1993; Psacharopoulos &

Patrinos, 1994). Consequently, the structural inequalities in income and wealth are reflected in urban settlement patterns of Indigenous peoples in Latin American cities (Del Popolo et al., 2007). In the case of metropolitan La Paz-El Alto, I found an uneven distribution of students of different wealth backgrounds and low levels of exposure between low- and high-wealth student, even though I used a long-tailed wealth index that understates wealth inequality.

This finding implies that the composition of the neighborhoods in La Paz-El Alto can be linked to socioeconomic stratification. Recent studies in the United States have shown evidence that neighborhood characteristics can have substantial effects on children's opportunities for intergenerational mobility (Chetty & Hendren, 2016; Chetty, Hendren, & Katz, 2016). Residential segregation adversely influences educational outcomes through several mechanisms, including collective socialization, social control, social capital, differential occupational opportunities, and institutional characteristics such as the availability and quality of schools (Ainsworth, 2002). Moreover, residential segregation can also negatively affect the efficiency in human capital investment and labor allocation, with adverse effects for the overall surplus of a city (Bénabou, 1993, 1996). If families make choices about where to live based on the social composition of neighborhoods, they face strong incentives to bid up land in neighborhoods with wealthier residents, which can lead to further socioeconomic stratification.

In addition, my findings showed evidence of high levels of school segregation based on ethnic and socioeconomic background. The Duncan Dissimilarity Index for Indigenous students as the reference group was 0.66; for low-wealth and high-wealth students, the score was 0.53 and 0.52, respectively. While there are no comparable studies of school segregation based on ethnicity in Latin America, my results can be compared to studies on socioeconomic school segregation in the region (Bellei, 2013; Murillo, 2016; Valenzuela, Bellei, & Ríos, 2014). In

Chile, the level of school segregation in urban centers in 2006 ranged from 0.20 to 0.80, and it was more pronounced in areas with a higher proportion of market mechanisms in the education systems (Valenzuela et al., 2014). Using data from TERCE, Murillo (2016) estimated an average Duncan Dissimilarity Index score of 0.53 for the bottom quartile and 0.57 for the top quartile of the income distribution. In the United States, school segregation between Black and White students in metropolitan areas averaged 0.62 (Whitehurst, Reeves, & Rodriguez, 2016). These comparisons show that schools in La Paz-El Alto are highly segregated, with implications for the quality of education students receive. Past research has shown that the socioeconomic composition of schools affects academic achievement (Billings et al., 2014; Rivkin, 2016; Rumberger, 2005). Therefore, my findings suggest that Indigenous students are less likely to benefit from the resources and exposure to high-achieving students in their classrooms, with adverse effects on their academic achievement.

Are there disparities in school accessibility?

In addition, this study revealed high disparities in school accessibility based on the ethnic and socioeconomic composition of different neighborhoods. Students who live in neighborhoods with a high proportion of Indigenous students have lower levels of school accessibility. Neighborhoods with at least 90% of non-Indigenous student residents have on average 16 more schools than neighborhoods with 90% of Indigenous student residents, even after controlling for population size and distance from the city center. Moreover, building on earlier studies (Andersson et al., 2012; Burde & Linden, 2013; Frenette, 2004), I showed that distance to educational institutions has an inverse relationship with enrollment in schools; as the distance between students' homes and schools increases, the likelihood of enrollment declines. At the same time, I found that low-wealth students are more likely to send their children to nearby schools than high-wealth students are. These results suggested that children in neighborhoods with a high proportion of Indigenous or low-wealth students have lower access to educational opportunities in La Paz-El Alto, with negative implications for their educational attainment, academic achievement, and intergenerational mobility.

In addition, school accessibility does not only depend on the number of schools available in each neighborhood. Like earlier studies on disparities in accessibility to opportunities in urban areas (Delmelle & Casas, 2012; Páez et al., 2010, 2012), the present study found that having access to affordable, safe, comfortable, and reliable modes of transportation can significantly expand school accessibility. Students of the same ethnic and socioeconomic background have different levels of school accessibility, depending on whether they have access to motorized transportation. A student who is Indigenous, comes from the lowest third of the wealth distribution, and lives 10 kilometers away from school is just as likely to walk to school as a student who is not Indigenous, comes from the highest third of the wealth distribution, and lives next to the school he/she attends. This finding supported earlier research on transportation disadvantage based on ethnicity, race, and socioeconomic background (Attoh, 2012; Shay et al., 2016). Economically disadvantaged urban residents tend to spend a greater share of either their time or their income on transportation (GAMLP, 2015; Sosa, 2010), which limits their accessibility to opportunities and contributes to social inequality.

Moreover, my interviews with parents showed the challenges they face to enroll their children in schools and the processes that contribute to social stratification in schools. Because of differences in the perceived school quality, many parents make an extra effort to enroll their children in schools that are farther from home, sometimes waiting in line for months. Technically, public schools are not allowed to charge parents tuition and admissions are not restricted by catchment areas, which previous studies have argued can counter social stratification in schools (MacLeod & Urquiola, 2009). However, the parents' associations impose barriers to school accessibility on low-income, often Indigenous families. The parents' associations charge membership fees to parents, require parental involvement in meetings and marches, and impose monetary penalties on parents who do not comply. If the school needs an improvement to its infrastructure or needs to hire an additional teacher, the parents' association organizes marches and protests to pressure the government to increase spending in their school. If that strategy does not work, then parents are expected to make donations to the school. Parents who do not comply must accept that their children can be excluded from using the new school acquisitions. In this way, the school can push out families who cannot afford making contributions, without directly expelling students. Therefore, even among public schools, social stratification can emerge and contribute to differences in the quality of education that students receive.

Beyond these barriers to accessibility, one of the most important concerns that families have in deciding where to send their children to school is how they will organize their commute to school. Like in other studies about school-commuting patterns (Mammen, Faulkner, Buliung, & Lay, 2012; Oluyomi et al., 2014), I found that parents in La Paz-El Alto have serious concerns about their children's safety. Since public schools do not have publicly-funded buses, parents must rely in a range of paid motorized modes of public transportation to send their children to school. However, they fear that their children will experience robberies, sexual abuse, and kidnappings when using the minibuses, micros, buses, and even private school buses. Families often shared examples of negative experiences they had while using public transportation such as being robbed, having to argue with the driver, or simply being uncomfortable. To many, the risk of kidnappings became a particularly worrisome possibility after a student was robbed from her school by an adult who pretended to be her babysitter. Families are thus experiencing more fear today than in the past about the risk of losing their children if they travel alone to school. For families who can afford it, the problem can be easily solved with private transportation. By contrast, families who cannot afford it must either send their children to the local school or spend significant amounts of money in public transportation. This mechanism further contributes to school segregation as it creates a strong incentive for families to send their children to schools that are closest to home to avoid the risks and costs of a long and motorized school commute.

Does mass transit reduce school segregation?

The results provided evidence that mass transit influenced where students enroll in school. The size of the effect was small, but statistically significant. I found that mass transit availability was associated with a greater number of students from El Alto switching to schools of La Paz. This finding provided additional evidence to that of earlier studies on the effects of transportation policy on school segregation of various forms (Angrist & Lang, 2004; Billings et al., 2014; Colin Pescina, 2015; Muralidharan & Prakash, 2013). Because the impact of mass transit varied by socioeconomic status, I argued that it expanded school accessibility for low-wealth students and reduced socioeconomic school segregation. Students in the lowest tercile of the wealth distribution were more likely to switch schools after the cable car lines were introduced. This finding was consistent with the hypothesis that the income elasticity of the demand for either transportation or schooling is greater for individuals who make relatively lower incomes. Low-income families tend to spend a greater proportion of their income on transportation than higher-income families do (CAF, 2011; GAMLP, 2015). If mass transit reduces the cost of transportation, low-income families experience an increase in their disposable income, which can induce them to trade the proximity of a nearby school for the advantages of faraway schools.

In addition, my qualitative research revealed that one of the most significant advantages of the cable-car system over other modes of transportation relates to quality of service. Families who use the cable car system described it as faster, cheaper, more comfortable, reliable, and convenient than other modes of transport. Whether families enjoy one or many of these benefits depends largely on their situation, the location of their homes in relation to the station, the location of schools, and their perceptions of the relative quality of local schools versus schools in La Paz. For those who do use the cable car regularly, the long list of benefits cannot be reduced to monetary savings. The quality of life improves when people can avoid the busy and congested streets; their situation improves when they can avoid being blocked by protests or marches; their days are a bit easier when they do not have to push others to get a seat on a minibus or when parents know they can expect their children to get home at a reliable, consistent, and reasonable hour.

Contributions to Existing Research

The findings in this study contributed to existing research on school segregation, transportation policy, and equality of educational opportunity (Angrist & Lang, 2004; Billings et al., 2014; Colin Pescina, 2015; Muralidharan & Prakash, 2013). These studies have shown that transportation policy interventions, coupled with open admission policies, for disadvantaged groups can reduce school segregation based on race, socioeconomic status, academic ability, or gender. The present study contributes to this literature by showing that in the case of metropolitan La Paz-El Alto, the introduction of a cable-car system increased reduced school segregation based on ethnicity and socioeconomic background. In this way, the study adds a new case to the literature that supports the strong link between transportation policy and equality of educational opportunity.

However, more research is needed to determine the extent to which the reduction in school segregation translates into better educational outcomes. On one hand, students who benefit from the cable car system can take advantage of the greater school accessibility. The costs they face to enroll in schools they perceive to be superior are lowered by mass transit, so they are more likely to commute out of their neighborhood to enroll in school. Their educational outcomes might improve depending on the quality of their destination school, with positive implications for educational equity. On the other hand, new students in the destination schools can also displace peers who would otherwise have enrolled. Since I completed the study, conflict has emerged in schools between parents who live near the school and parents who commute from faraway. These tensions bring to light the limits of mass transit in reducing school segregation. More research would be needed to explore the dynamics of interaction among students in schools and their families around them.

Moreover, this study fills in a gap in the literature on ethnic and socioeconomic segregation in Bolivia. This is the first study in which data from matriculation records were used to estimate the levels of residential and school segregation in metropolitan La Paz-El Alto. Unlike earlier studies that used census or survey data (Del Popolo et al., 2007; Gray-Molina et al., 2002), in this dissertation I relied on annual matriculation records, which provided sufficient socio-demographic detail to calculate a wealth index and related it to students' ethnic background. From a methodological standpoint, this study contributed a straightforward method to calculate student wealth that can be used to analyze segregation patterns in neighborhoods and schools not just in La Paz-El Alto, but also in the rest of the country. One of the central contributions of this analysis was the clear evidence that neighborhoods and schools with a greater proportion of students who are Indigenous tend to have lower levels of student wealth.

In addition, this study contributed to the literature on school accessibility, which tends to focus on measuring the cumulative opportunities that students have in a given area (Páez et al., 2010, 2012; Williams & Wang, 2014). I showed that school accessibility also depends on a range of other factors beyond a simple count of the available opportunities. Through qualitative research, this dissertation showed that families in La Paz-El Alto experience concern about the lack of safety of existing modes of transportation. The detailed study of families' experiences in organizing their children's school commute revealed the several challenges they face to secure access to education for their children. Those challenges included the lack of affordable, safe, efficient, and comfortable motorized transportation.

In this context, this study showed that mass transit can improve school accessibility and reduce school segregation. This study offers new evidence of the effects of mass transit on where students go to school. As Colin Pescina (2015) showed in the context of Mexico City, this study demonstrated that the introduction of a mass transit system allows students to travel farther away from home to enroll in schools of their preference. Unlike Colin Pescina (2015), however, this dissertation differentiated the effects of mass transit by students' ethnicity and socioeconomic background. In this way, this study adds a new perspective on the relationship between student background and the effect of mass transit on where students go to school. Moreover, unlike earlier studies in the literature, this is the first study to combine quantitative and qualitative methods to analyze the relationship between segregation, transportation polity, and equality of educational opportunity.

In sum, the main contributions of this dissertation are the detailed documentation of the levels of residential and school segregation that students experience in La Paz-El Alto; an analysis of the relationship between residential segregation and school accessibility; a description of the barriers that families face to access educational opportunities for students; an analysis of the role that lack of transportation plays in producing disparities in school accessibility; and an assessment of the effects of mass transit on school accessibility and school segregation. This study fills a gap in the literature on segregation, transportation policy, and educational equity. No prior study has looked at how the introduction of a mass transit system based on cable cars influences the level of access to schools as well as the social or ethnic composition of schools. Moreover, unlike other studies on the effects of transportation policy interventions on school accessibility and school segregation, I used a combination of quantitative and qualitative research methods that revealed not only the scale of the impact but also the possible mechanisms through which mass transit influences school accessibility and segregation.

Policy Implications

The central policy question in education in Bolivia relates to the state's broad aim to create an education system that is inclusive, non-discriminatory, and equitable. Moreover, the state also has set out to promote intercultural, intracultural, and multilingual education that is designed to serve Indigenous and non-Indigenous students alike (Cortina, 2014). The high level of segregation that currently exists in the system is a significant barrier in the way of the state achieving that goal. Mestizo and Aymara students, the two largest identity groups in metropolitan La Paz-El Alto, are unlikely to share either the same neighborhoods or schools. Segregated neighborhoods produce segregated schools, which in turn translates into little intergroup contact. The low interaction and contact between these two groups contributes to the formation of negative stereotypes that feed into discriminatory practices. The first policy implication, therefore, is that the high levels of segregation revealed in this study can provide justification for more intentional ways to desegregate schools or encourage intergroup contact through other means.

The second relevant policy question pertains to how to increase school accessibility in the context of metropolitan La Paz-El Alto. One way to do this is to build or improve schools that are close to families' homes. The national and municipal governments have made several efforts to achieve this goal with mixed results. Parents I interviewed reported that schools on the periphery of the city often have unqualified teachers because more experienced teachers with higher qualifications do not want to teach there. Several "rural" schools are within the city, yet teachers prefer not to teach in them because they are far from the center and under-resourced. Moreover, a state official in the municipal government told me that schools built by the municipal government in the peripheral neighborhoods are relatively empty; the students are not matriculating there because of perceived low quality. In this context, building more schools in areas that do not have enough people to support the investment of that level would not work.

An alternative policy intervention would be to support modes of transport with steep discounts for disadvantaged students so they can reach a wider range of potential educational opportunities. Both the *PumaKatari* and the *Teleférico* employ this model. They subsidize the transportation of students by offering them discounts. The *PumaKatari* charges a flat rate for anyone who is under 18 years of age, while the *Teleférico* gives a 50% discount to students on any trip. This research has shown that both systems have been a welcome addition to the options that families have to organize their children's commute to school. They address one of the most important challenges that families face: the lack of safety in other modes of transport. However, neither the *PumaKatari* nor the *Teleférico* were designed specifically for children. Parents have to travel with their children, particularly the younger ones, to take them to school. Therefore, there appears to be a clear need for a more concerted public policy effort to offer school busing.

The municipal government's "Plan Integral La Paz 2040" lists a number of policies that were suggested in the meeting of leaders who gathered to develop a vision for the next few decades (GAMLP, 2015). In the policy area of mass transit, the policy framework is divided between transport regulation and transport provision. In terms of provision of transport, the government aims to consolidate the *PumaKatari* busing system with new routes, integrated with the *Teleférico*, and even acquiring a fleet of buses with two floors. In addition, the government lists the implementation of a school busing system (p. 98). However, through interviews with officials in the municipal government, I learned that there are no serious plans to make that goal a reality anytime soon. In fact, the *PumaKatari* was originally idealized as a school busing system, but the cost of a system of that kind was prohibitive, so they expanded their concept to a mass transit system for everyone. Even at that level, the prices that the *PumaKatari* charges are not enough to cover the operating costs, so the municipal government subsidizes this form of mass transit. In addition, because the national government subsides gasoline in the country, the cost of transport is lower than it would be if passengers were to pay the full cost of fuel.

Nevertheless, my research has shown that an informal sector of school buses emerged in recent years in public schools. Parents are the driving force behind it, providing the vehicles, organizing the routes, and pressuring schools to regulate the system. They are demanding transport services that meet their complex mobility needs. The fear that families now feel due to greater insecurity has provided increasing support for school busing. Stories of kidnapping of students from schools, congested streets, the risk of accidents, and the poor conditions of traditional modes of motorized transport such as the minibuses or the micros, have convinced many parents that school buses are a better alternative to organize their children's commute to school. Mass transit systems such as the *PumaKatari* and the *Teleférico* are viable solutions of the families who live near their stations, but they do little to support families who are not near their networks. Given the strong demand from parents, one possible path forward might be a public-private partnership where the government subsidizes the transportation fees of low-income families while other families pay the full rate. They might also pro-rate the subsidies based on distance to school to even out the cost of transportation among families who live close and far away from schools. Ultimately, future solutions will emerge out of complex political processes and policy decisions that are beyond the scope of this dissertation.

Questions for Future Research

While this dissertation has provided some evidence that mass transit reduces school segregation based on ethnicity and socioeconomic background, I have said nothing about how students experience these changes within schools. Segregation can take place even within the classroom environment, so mixing of students within the same school might do little to promote inter-group contact. Similarly, I have not conducted research directly with students. A follow-up study would be served by collecting accounts from students themselves and their experiences of segregated schools as well as their various experiences of their commutes to school. Moreover, this study did not have detailed origin-destination data to compare mass transit options to their alternatives, as it is typically done on mode of transport choice studies. This would be a large undertaking that would require a purposefully designed survey with questions about all modes of transport available to individuals, their attributes, their place of origin, and their place of destination. A study of this scale would be beyond the scope of my possibilities. Furthermore, my model of the effect of mass transit on where families send their children to school cannot rule out all unobservable factors that influence parents' decisions. A controlled experiment that randomly assigns free cable car tickets to some but not to others might be an improvement over my study, but it would require additional funding.

Second, my study did not focus on gender issues, but it was a common theme that emerged in my interviews. A follow-up study might focus specifically on how women experience the challenges of limited school accessibility. In this study, I found evidence of the importance of this question from interviews with mothers who struggled to convince their husbands to pay for motorized transportation, from women who said they had experienced sexual harassment in mass transit, from mothers who feared sending their daughters in the school bus for fear of sexual abuse by their older peers. These issues are complex and significant, so they would deserve their own treatment in a separate research project.

I cannot say anything about the impact of mass transit on student learning outcomes. An easier commute to school could have benefits that contribute to improved student outcomes. Shorter commutes might translate into more time for studying, and allow students to rest more before going to schools, arrive home earlier, and be exposed to fewer risks that cause anxiety. However, it would be challenging to test this hypothesis because students who use mass transit systems might be different from those who do not in ways that are associated with their student achievement. For example, my study showed that students who come from either extreme of the wealth distribution are more likely to use the *Teleférico* than students who are in the middle. One way to get around this problem could be to randomly select students who are in the same neighborhood and attend the same school—and randomly distribute free transportation tickets for mass transit and for the minibus to compare the results.

In addition, this study is only based on a partial equilibrium model as opposed to a general equilibrium model. A long-term study of the processes of segregation, transportation policy, and educational equity would need to consider changes in real estate markets. For example, as the demand for the cable car system increases, the land near cable car stations will become more valuable. Real estate prices are likely to increase in areas that are located close to the stations, which would push out low-income residents. Processes of gentrification could be triggered, which would have the potential to eliminate any of the equity benefits of cheaper transportation for low-income residents. At the same time, the higher demand for schools that are close to the cable car station might lead to schools charging formal or informal enrollment and tuition fees. The higher price of schooling would also nullify any benefits that low-income families might have from lower transportation costs. Finally, even if mass transit allows for low-income students to reach new schools, there is no guarantee that school segregation will always be reduced. In some schools, it is possible that students from El Alto could displace students from La Paz. If both groups of students share the same socioeconomic background, then there would not be a substantive change in the socioeconomic composition of the school. More detailed research would be need to investigate the dynamics within schools to determine the extent to school mass transit makes a different in educational outcomes.

Figure 1. Cholitas sitting in MegaCenter

Figure 2. "Little hygiene and education"

Table 1. *Conceptual Binaries*

Segregation	vs.	Desegregation
Separation		Integration
Division		Unity
Disconnect		Connect
Isolation		Exposure
Distance		Closeness
Difference		Similitude
Unevenness		Evenness
Exclusion		Inclusion

Equality	vs.	Inequality
Justice		Injustice
Fairness		Unfairness
Equity		Inequity
Balance		Imbalance

Accessibility	vs.	Inaccessibility
Mobility		Immobility
Movement		Unfairness
Access		Inequity
Balance		Imbalance

Figure 3. Conceptual framework

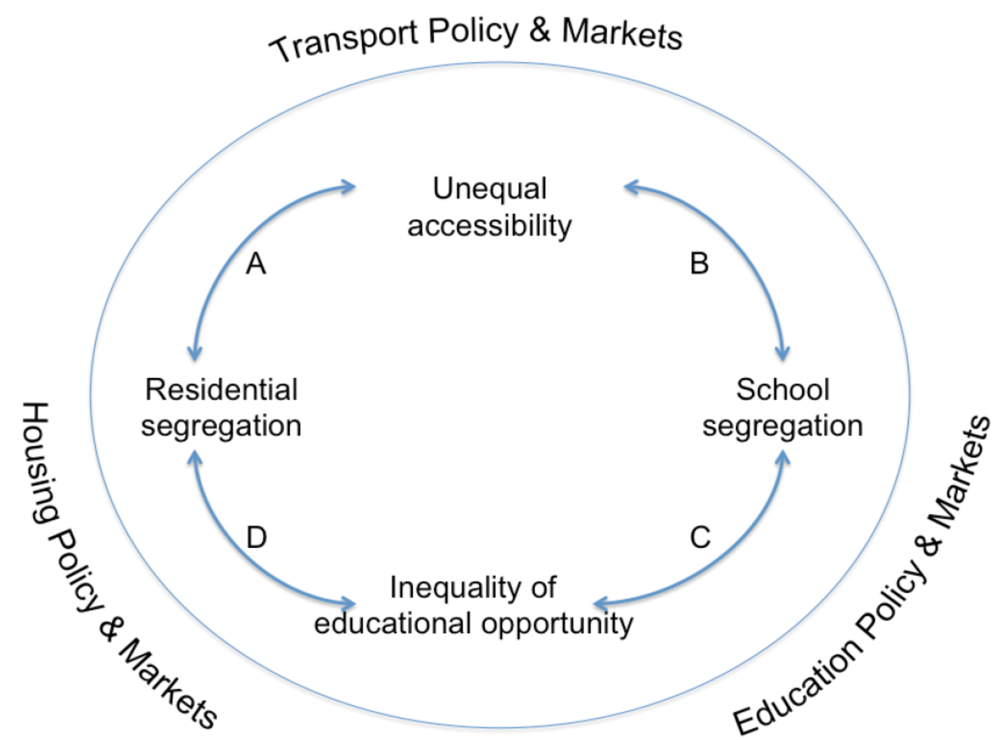
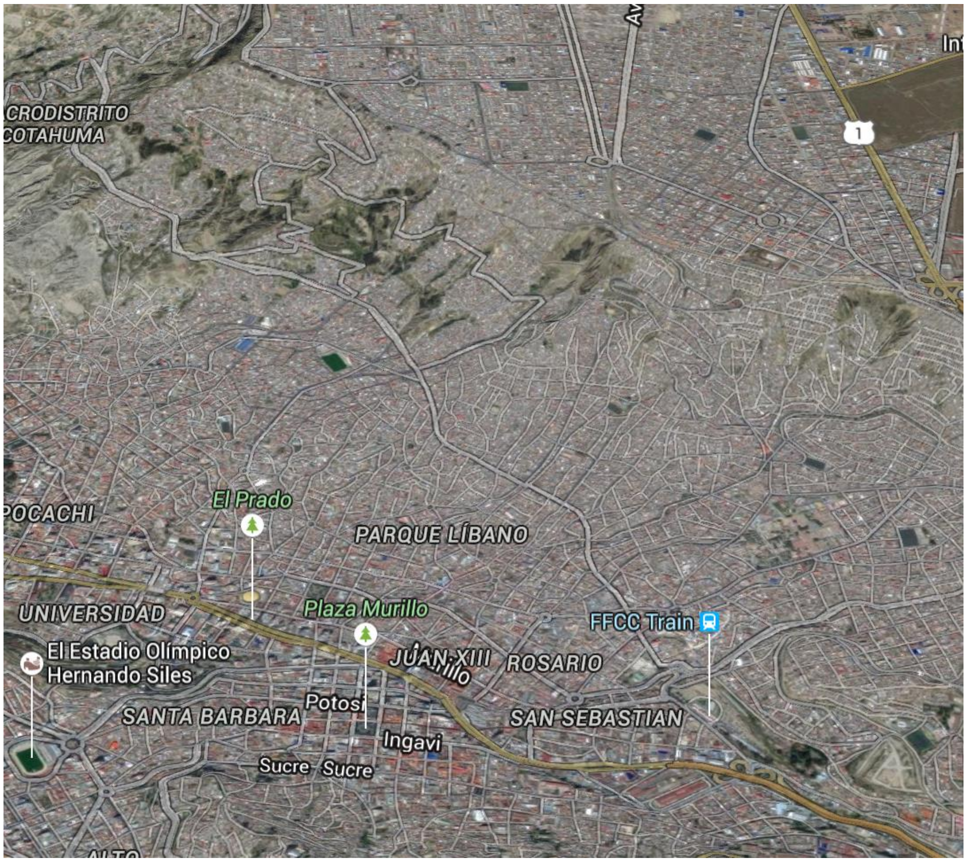


Figure 4. Florentino Olivares, *El cerco de La Paz*, 1781

Source: Museo Casa de Murillo, Bolivia (Serulnikov, 2012).

Figure 5. Satellite image of the Center of La Paz 2016

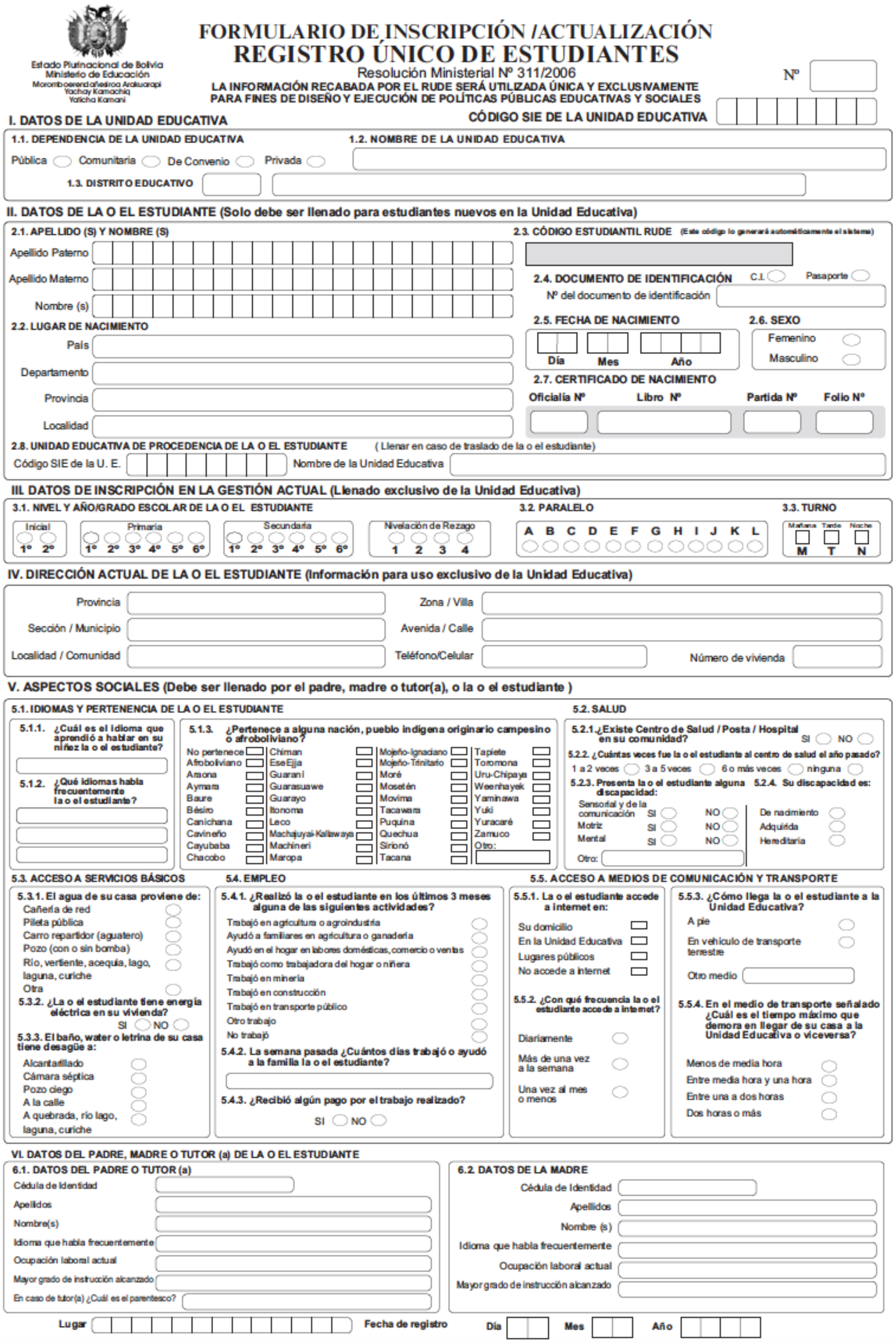


Source: Google Earth

Table 2. *Research Design Framework*

Goals	Objectives	Task	Products	Outcomes
To better understand school segregation in the metropolitan area of La Paz-El Alto	To identify factors associated with school segregation To measure the current degree of school segregation	Interview families about barriers to educational access Calculate indicators of school segregation	Testimonies from families about barriers to educational access Comparable estimates of the dissimilarity and isolation indexes Maps of school and residential segregation	Greater awareness about the extent of social segregation in schools
To assess the extent of inequality in students' ability to move around the city to access educational opportunities	Identify strategies of mobility: the ways in which students commute to school To measure disparities in accessibility to schooling	Interview families about their commuting strategies Calculate indicators of accessibility to schooling	Testimonies of families about how they send their children to school Comparable estimates of school accessibility Maps of school accessibility by transportation mode Estimates of the probability of motorized transportation use	Greater awareness about the extent of transportation inequality by students
To assess the impact of mass transit on inequality of educational opportunity and school segregation.	Measure the impact of mass transit on how students travel to school To measure the impact of mass transit on where students study To measure the impact of mass transit on the social composition of schools	Calculate the probability that students in El Alto will use mass transit Calculate the effect of mass transit on school choice Calculate the percentage change in the proportion of students in La Paz who come from El Alto	Estimates of the impact of mass transit on students' travel-to-school mode Estimates of the impact of mass transit on students' choice of school Estimates of the impact of mass transit on La Paz schools' share of students from El Alto	Greater awareness about the impact of mass transit on educational inequality

Figure 6. Sample matriculation form



Estado Plurinacional de Bolivia
Ministerio de Educación
Morombaerenda ñeiroa Arakuarapi
Yachay Kamachiq
Yaticha Kamani

FORMULARIO DE INSCRIPCIÓN /ACTUALIZACIÓN
REGISTRO ÚNICO DE ESTUDIANTES
Resolución Ministerial Nº 311/2006
LA INFORMACIÓN RECABADA POR EL RUDE SERÁ UTILIZADA ÚNICA Y EXCLUSIVAMENTE PARA FINES DE DISEÑO Y EJECUCIÓN DE POLÍTICAS PÚBLICAS EDUCATIVAS Y SOCIALES

Nº

CÓDIGO SIE DE LA UNIDAD EDUCATIVA

I. DATOS DE LA UNIDAD EDUCATIVA

1.1. DEPENDENCIA DE LA UNIDAD EDUCATIVA
Pública Comunitaria De Convenio Privada

1.2. NOMBRE DE LA UNIDAD EDUCATIVA

1.3. DISTRITO EDUCATIVO

II. DATOS DE LA O EL ESTUDIANTE (Solo debe ser llenado para estudiantes nuevos en la Unidad Educativa)

2.1. APELLIDO (S) Y NOMBRE (S)
Apellido Paterno
Apellido Materno
Nombre (s)

2.2. LUGAR DE NACIMIENTO
País
Departamento
Provincia
Localidad

2.3. CÓDIGO ESTUDIANTIL RUDE (Este código lo generará automáticamente el sistema)

2.4. DOCUMENTO DE IDENTIFICACIÓN C.I. Pasaporte
Nº del documento de identificación

2.5. FECHA DE NACIMIENTO
Día Mes Año

2.6. SEXO
Femenino
Masculino

2.7. CERTIFICADO DE NACIMIENTO
Oficialía Nº Libro Nº Partida Nº Folio Nº

2.8. UNIDAD EDUCATIVA DE PROCEDENCIA DE LA O EL ESTUDIANTE (Llenar en caso de traslado de la o el estudiante)
Código SIE de la U. E. Nombre de la Unidad Educativa

III. DATOS DE INSCRIPCIÓN EN LA GESTIÓN ACTUAL (Llenado exclusivo de la Unidad Educativa)

3.1. NIVEL Y AÑO/GRADO ESCOLAR DE LA O EL ESTUDIANTE
Inicial 1º 2º
Primaria 1º 2º 3º 4º 5º 6º
Secundaria 1º 2º 3º 4º 5º 6º
Nivelación de Rezago 1 2 3 4

3.2 PARALELO
A B C D E F G H I J K L

3.3. TURNO
Mañana Tarde Noche
M T N

IV. DIRECCIÓN ACTUAL DE LA O EL ESTUDIANTE (Información para uso exclusivo de la Unidad Educativa)

Provincia Zona / Villa
Sección / Municipio Avenida / Calle
Localidad / Comunidad Teléfono/Celular Número de vivienda

V. ASPECTOS SOCIALES (Debe ser llenado por el padre, madre o tutor(a), o la o el estudiante)

5.1. IDIOMAS Y PERTENENCIA DE LA O EL ESTUDIANTE

5.1.1. ¿Cuál es el idioma que aprendió a hablar en su niñez la o el estudiante?

5.1.2. ¿Qué idiomas habla frecuentemente la o el estudiante?

5.1.3. ¿Pertenece a alguna nación, pueblo indígena originario campesino o afroboliviano?

No pertenece, Afroboliviano, Araona, Aymara, Baure, Bésiro, Canichana, Cavineño, Cayubaba, Chacobo, Chiman, Ese Ejja, Guaraní, Guarasuawe, Guarayo, Itonoma, Leco, Machajuyai-Kallawaya, Machineri, Maropa, Mojeño-Ignaciano, Mojeño-Trinitario, Moré, Mosetén, Movima, Tacawara, Puquina, Quechua, Sirionó, Tacana, Tapiete, Toromona, Uru-Chipaya, Weenhayek, Yaminawa, Yuki, Yuracaré, Zamuco, Otro:

5.2. SALUD

5.2.1. ¿Existe Centro de Salud / Posta / Hospital en su comunidad? SI NO

5.2.2. ¿Cuántas veces fue la o el estudiante al centro de salud el año pasado?
1 a 2 veces 3 a 5 veces 6 o más veces ninguna

5.2.3. Presenta la o el estudiante alguna discapacidad:
Sensorial y de la comunicación SI NO
Motriz SI NO
Mental SI NO
Otro:

5.2.4. Su discapacidad es:
De nacimiento
Adquirida
Hereditaria

5.3. ACCESO A SERVICIOS BÁSICOS

5.3.1. El agua de su casa proviene de:
Cañería de red
Pileta pública
Carro repartidor (aguatero)
Pozo (con o sin bomba)
Río, vertiente, acequia, lago, laguna, curiche
Otra

5.3.2. ¿La o el estudiante tiene energía eléctrica en su vivienda?
SI NO

5.3.3. El baño, water o letrina de su casa tiene desagüe a:
Alcantarillado
Cámara séptica
Pozo ciego
A la calle
A quebrada, río lago, laguna, curiche

5.4. EMPLEO

5.4.1. ¿Realizó la o el estudiante en los últimos 3 meses alguna de las siguientes actividades?
Trabajó en agricultura o agroindustria
Ayudó a familiares en agricultura o ganadería
Ayudó en el hogar en labores domésticas, comercio o ventas
Trabajó como trabajadora del hogar o niñera
Trabajó en minería
Trabajó en construcción
Trabajó en transporte público
Otro trabajo
No trabajó

5.4.2. La semana pasada ¿Cuántos días trabajó o ayudó a la familia la o el estudiante?

5.4.3. ¿Recibió algún pago por el trabajo realizado?
SI NO

5.5. ACCESO A MEDIOS DE COMUNICACIÓN Y TRANSPORTE

5.5.1. La o el estudiante accede a internet en:
Su domicilio
En la Unidad Educativa
Lugares públicos
No accede a internet

5.5.2. ¿Con qué frecuencia la o el estudiante accede a internet?
Diariamente
Más de una vez a la semana
Una vez al mes o menos

5.5.3. ¿Cómo llega la o el estudiante a la Unidad Educativa?
A pie
En vehículo de transporte terrestre
Otro medio

5.5.4. En el medio de transporte señalado ¿Cuál es el tiempo máximo que demora en llegar de su casa a la Unidad Educativa o viceversa?
Menos de media hora
Entre media hora y una hora
Entre una a dos horas
Dos horas o más

VI. DATOS DEL PADRE, MADRE O TUTOR (a) DE LA O EL ESTUDIANTE

6.1. DATOS DEL PADRE O TUTOR (a)
Cédula de Identidad
Apellidos
Nombre(s)
Idioma que habla frecuentemente
Ocupación laboral actual
Mayor grado de instrucción alcanzado
En caso de tutor(a) ¿Cuál es el parentesco?

6.2 DATOS DE LA MADRE
Cédula de Identidad
Apellidos
Nombre (s)
Idioma que habla frecuentemente
Ocupación laboral actual
Mayor grado de instrucción alcanzado

Lugar Fecha de registro Día Mes Año

Table 3. Students in Schools of Metropolitan La Paz-El Alto

	La Paz	El Alto	Other	Total
Enrolled Students	194,342	279,465	13,530	487,337

Ethnicity	La Paz	El Alto	Other	Total
Aymara	39.23%	82.28%	95.66%	65.48%
Mestizo	31.75%	6.97%	1.19%	16.69%
Quechua	0.71%	0.51%	0.43%	0.59%
Eastern / Amazonian	0.45%	0.44%	0.24%	0.44%
Guarani	0.30%	0.31%	0.26%	0.31%
Afro-Bolivian	0.18%	0.07%	0.02%	0.11%
Other	4.32%	1.16%	0.31%	2.40%
N/A	23.05%	8.26%	1.89%	13.98%

Student Wealth Index	La Paz	El Alto	Other	Total
Lowest Tercile	27%	44%	96%	39%
Middle Tercile	37%	32%	2%	33%
Highest Tercile	36%	24%	1%	28%

School Quality Index	La Paz	El Alto	Other	Total
Lowest	21%	19%	37%	20%
Lower	22%	19%	20%	20%
Middle	14%	24%	18%	20%
Higher	18%	22%	5%	20%
Highest	25%	16%	19%	20%
Dropped out	2%	2%	3%	2%
Did not pass	2%	1%	1%	1%
Behind by 2+ years	7%	7%	9%	7%

Notes: "Other" includes the sections of *Palca*, *Mecapaca* and *Achocalla*, which collectively make up 3% of the metropolitan area. There were 501,726 students enrolled in schools of Metropolitan La Paz in 2014, but the dataset includes student background information for 97 percent of them. Student Wealth Index is an asset-based, composite factor that includes the availability of services such as piped water, electricity, sewage, Internet, and a nearby health care center, with an Eigenvalue of 0.99. The School Quality Index is a composite factor that includes the share of students who dropped out, the share who did not pass the year and the share who are behind by two years or more (Eigenvalue=1.12; number of schools=1,110).

Figure 7. Histogram of student wealth index raw scores

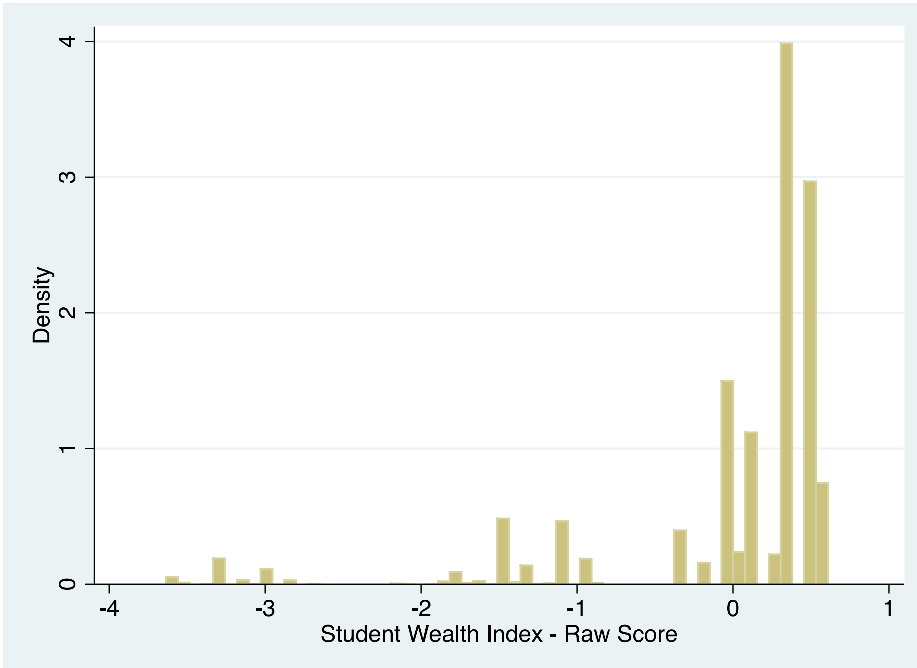


Figure 8. Histogram of student wealth index raw scores by municipality

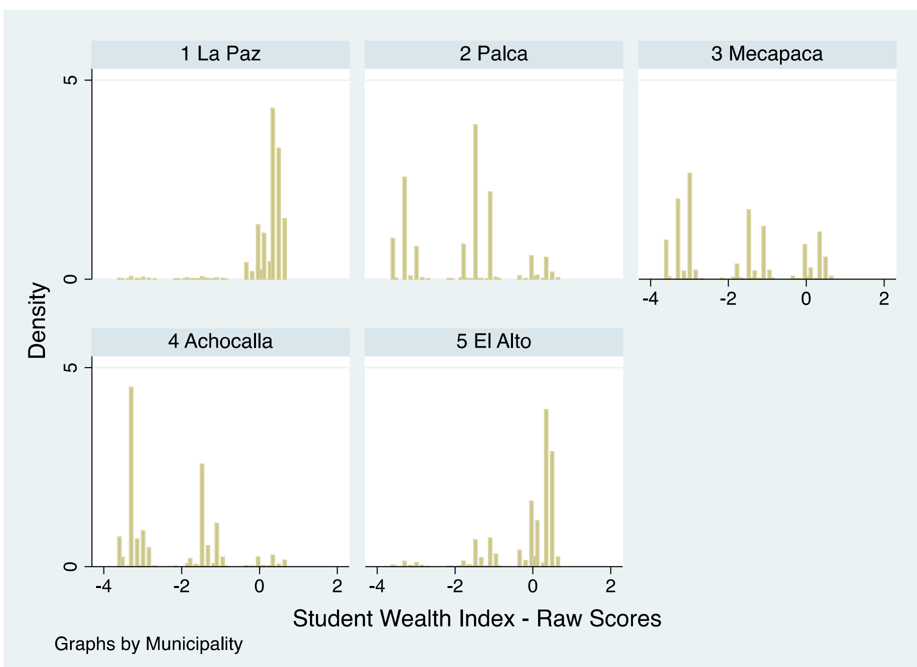


Table 4. *Residential and School Segregation Based on Ethnicity*

Panel A: Residential Segregation			
	All	La Paz	El Alto
Number of neighborhoods	433	176	255
Total number of students	445,109	179,356	265,450
Indigenous students	293,676	74,352	219,095
Share of total	0.66	0.41	0.83
Dissimilarity index	0.87	0.57	0.66
Isolation index	0.67	0.48	0.84
Interaction index	0.33	0.52	0.16
Panel B: School Segregation			
	All	La Paz	El Alto
Number of schools	1,100	500	484
Total number of students	487,337	194,342	279,465
Indigenous students	326,170	79,447	233,652
Share of total	0.67	0.41	0.84
Dissimilarity index	0.66	0.60	0.57
Isolation index	0.82	0.67	0.87
Interaction index	0.18	0.33	0.13

Notes: The number of students in panels A and B differ because of missing residential home address data. School segregation indictors were calculated with data from 1,110 schools with a total of 487,337 students. Residential segregation indicators were calculated with home address data of matriculated students, covering 433 neighborhoods with 445,109 students (91% of the matriculated students).

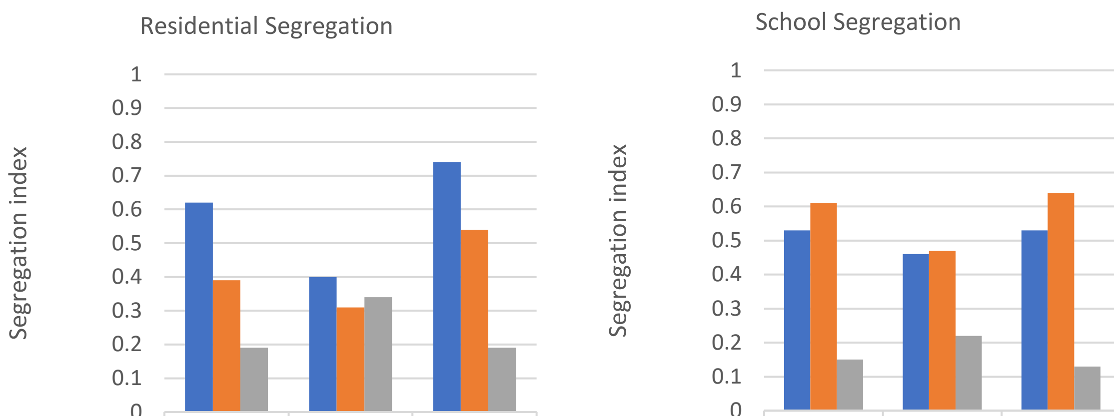
Figure 9. Residential and school segregation based on ethnicity

Table 5. *Residential and School Segregation Based on Student Wealth*

Panel A: Residential Segregation			
	All	La Paz	El Alto
Number of neighborhoods	433	176	255
Total number of students	445,109	179,356	265,450
Students in lowest wealth tercile	120,391	74,352	219,095
Share of total	0.36	0.27	0.43
Dissimilarity index	0.62	0.40	0.74
Isolation index	0.39	0.31	0.54
Interaction index	0.19	0.34	0.19
Students in highest wealth tercile	131,035	65,610	65,347
Share of total	0.29	0.25	0.37
Dissimilarity index	0.44	0.24	0.52
Isolation index	0.32	0.38	0.30
Interaction index	0.27	0.24	0.33
Panel B: School Segregation			
	All	La Paz	El Alto
Number of schools	1,100	500	484
Total number of students	487,337	194,342	279,465
Students in lowest wealth tercile	188,279	51,651	124,089
Share of total	0.39	0.27	0.44
Dissimilarity index	0.53	0.46	0.53
Isolation index	0.61	0.47	0.64
Interaction index	0.15	0.22	0.13
Students in highest wealth tercile	137,065	70,647	66,088
Share of total	0.28	0.36	0.24
Dissimilarity index	0.52	0.50	0.52
Isolation index	0.50	0.55	0.45
Interaction index	0.20	0.16	0.24

Notes: The wealth terciles come from an asset-based, composite factor that includes the availability of services such as piped water, electricity, sewage, and Internet in the student's home, and a health care center nearby (Eigenvalue=0.99).

Figure 10. Residential and school segregation for low-wealth students



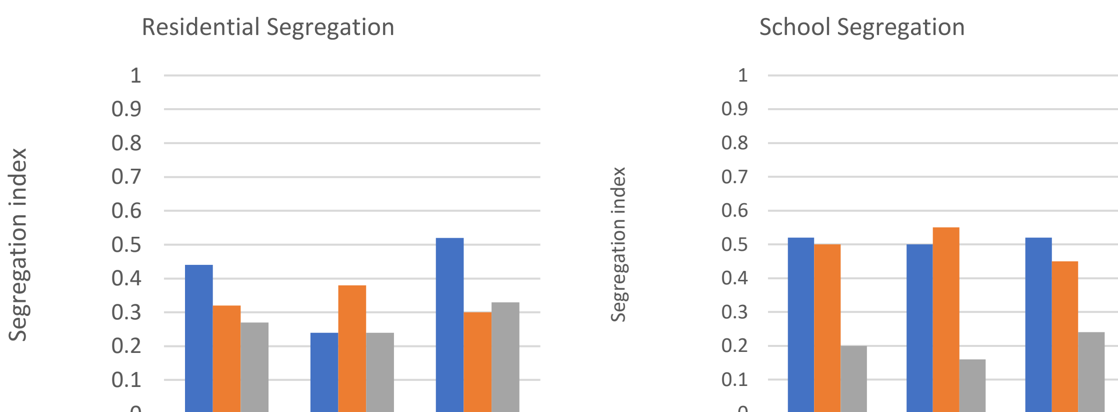
Residential Segregation

	All	La Paz	El Alto
Dissimilarity	0.62	0.4	0.74
Isolation	0.39	0.31	0.54
Interaction	0.19	0.34	0.19

School Segregation

	All	La Paz	El Alto
Dissimilarity	0.53	0.46	0.53
Isolation	0.61	0.47	0.64
Interaction	0.15	0.22	0.13

Figure 11. Residential and school segregation for high-wealth students



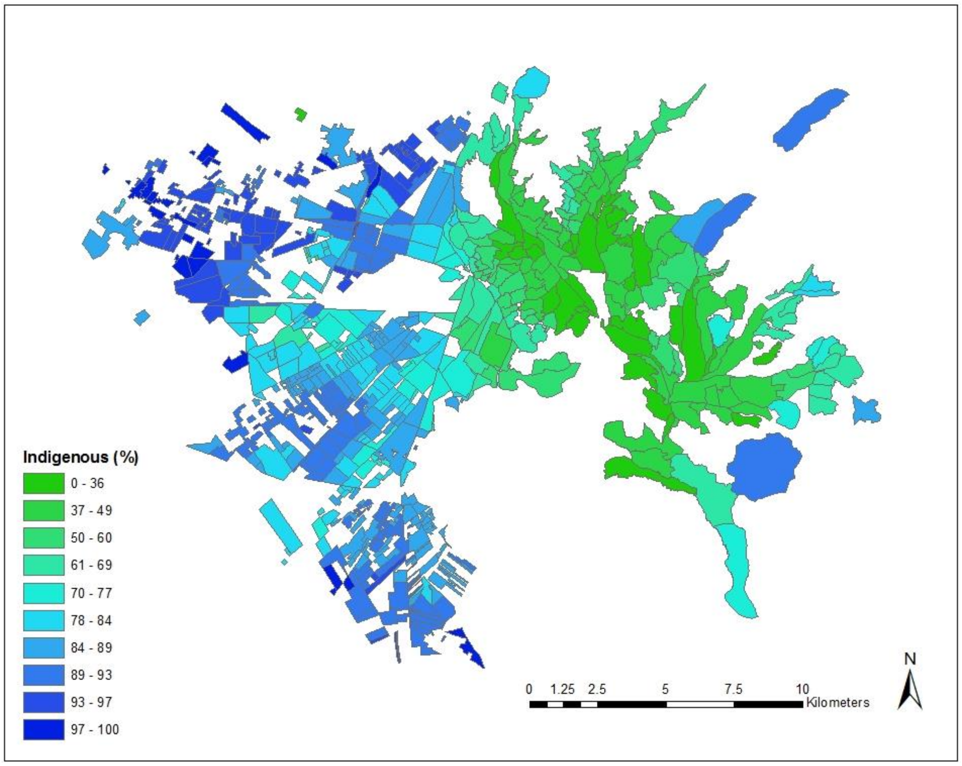
Residential Segregation

	All	La Paz	El Alto
Dissimilarity	0.44	0.24	0.52
Isolation	0.32	0.38	0.3
Interaction	0.27	0.24	0.33

School Segregation

	All	La Paz	El Alto
Dissimilarity	0.52	0.5	0.52
Isolation	0.5	0.55	0.45
Interaction	0.2	0.16	0.24

Figure 12. Maps of ethnic and socioeconomic residential segregation



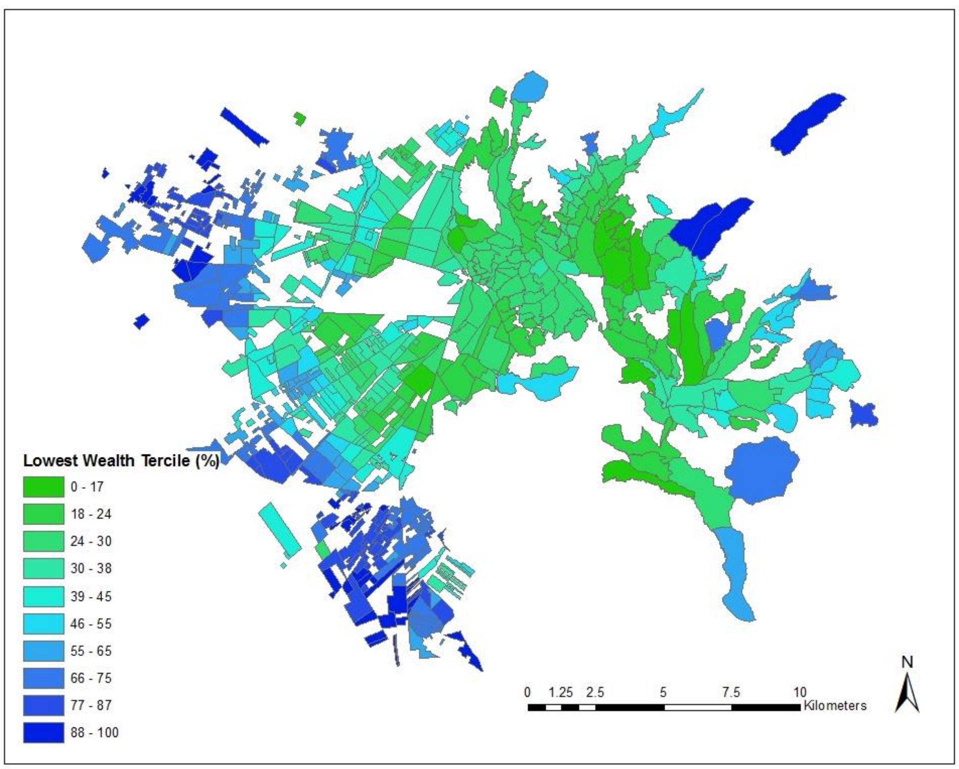


Figure 13. Student wealth and ethnicity by neighborhood

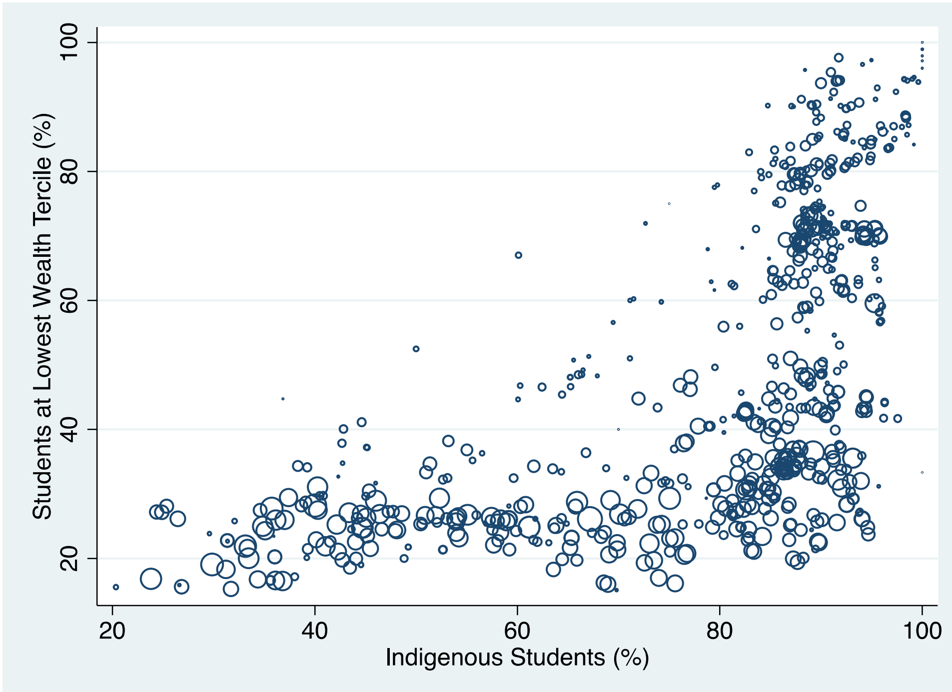
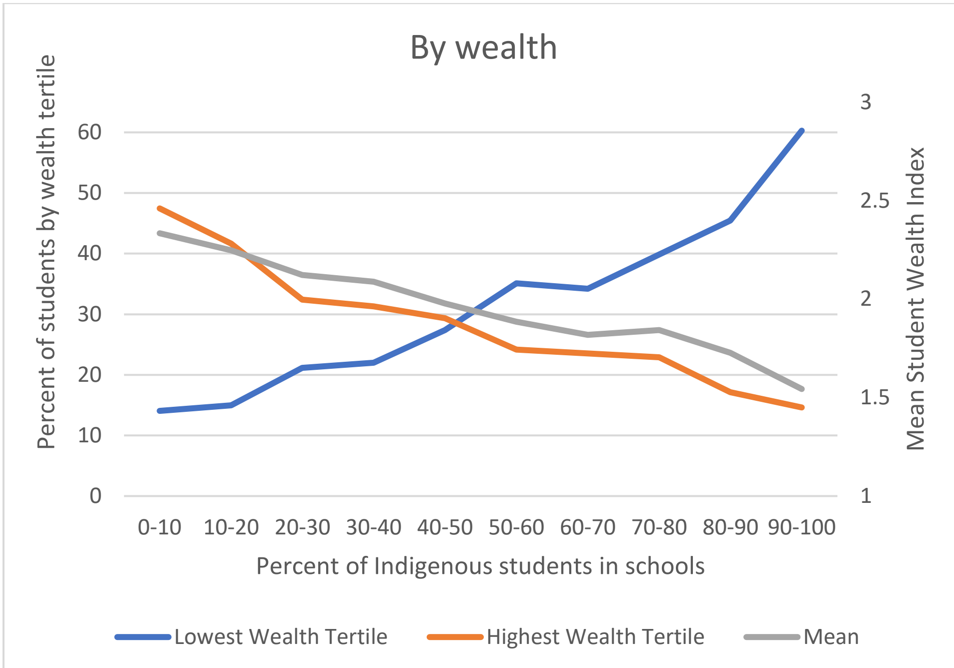
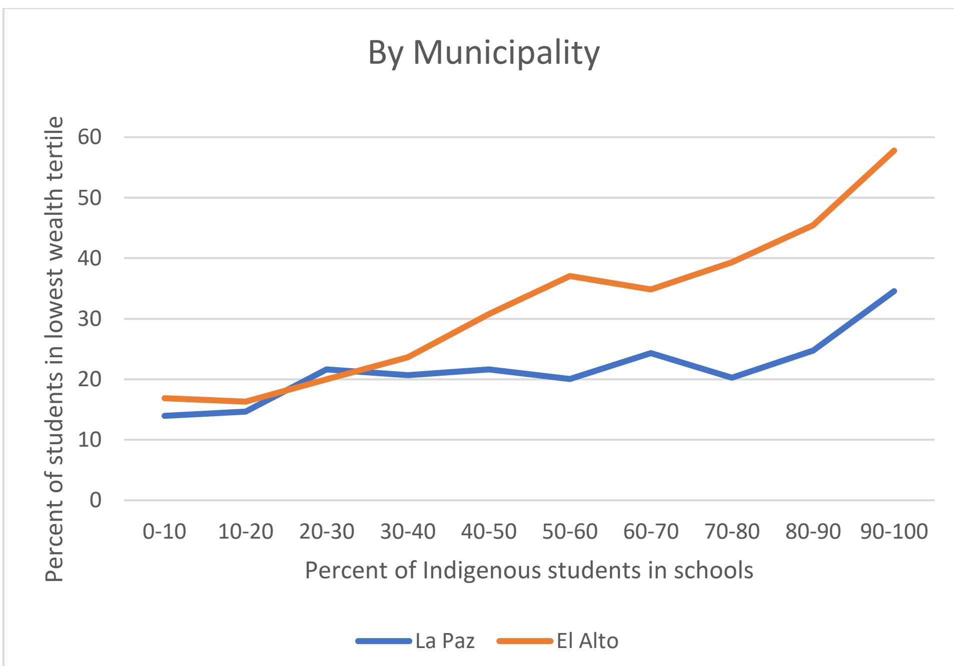


Figure 14. Student wealth and ethnicity in schools





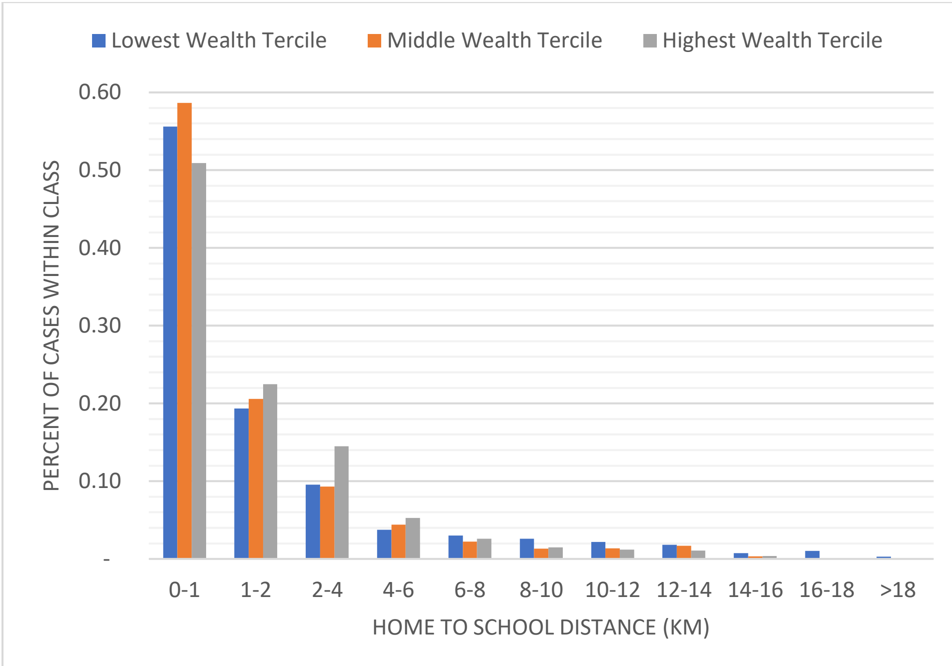
Notes: Students' wealth terciles are derived from an asset-based, composite factor that includes the availability of services such as piped water, electricity, sewage, Internet and a nearby health care center, with an Eigenvalue of 0.99 (*N*= 487,337), for the year 2014.

Table 6. *Summary Statistics to Estimate School Trip Length*

Variable	Mean	SD	Min.	Max.
Distance to school (ln)	6.77	1.30	1.88	10.09
Distance to school (meters)	1,945	2,965	7	24,197
Indigenous	0.68	0.47	0.00	1.00
Student Wealth Index	1.95	0.81	1.00	3.00
Female	0.49	0.50	0.00	1.00
Worker	0.28	0.45	0.00	1.00
Age	10.94	4.05	3.00	22.00
Motor Disability	0.00	0.04	0.00	1.00
School type				
Public	0.69	0.46	0.00	1.00
Mixed	0.13	0.34	0.00	1.00
Private	0.18	0.39	0.00	1.00
Mobility tool				
Walking	0.74	0.45	0.00	1.00
Micro	0.04	0.18	0.00	1.00
Bus	0.03	0.16	0.00	1.00
Minibus	0.21	0.41	0.00	1.00
Trufi	0.00	0.06	0.00	1.00
Taxi	0.00	0.05	0.00	1.00
Car	0.01	0.08	0.00	1.00
Other	0.00	0.03	0.00	1.00
Distance to center (meters)	6,338	3841	0.00	16,740
La Paz	0.41	0.49	0.00	1.00
El Alto	0.59	0.49	0.00	1.00

Notes: Number of observations=429,153.

Figure 15. Distribution of home-to-school trip distance by wealth and ethnicity



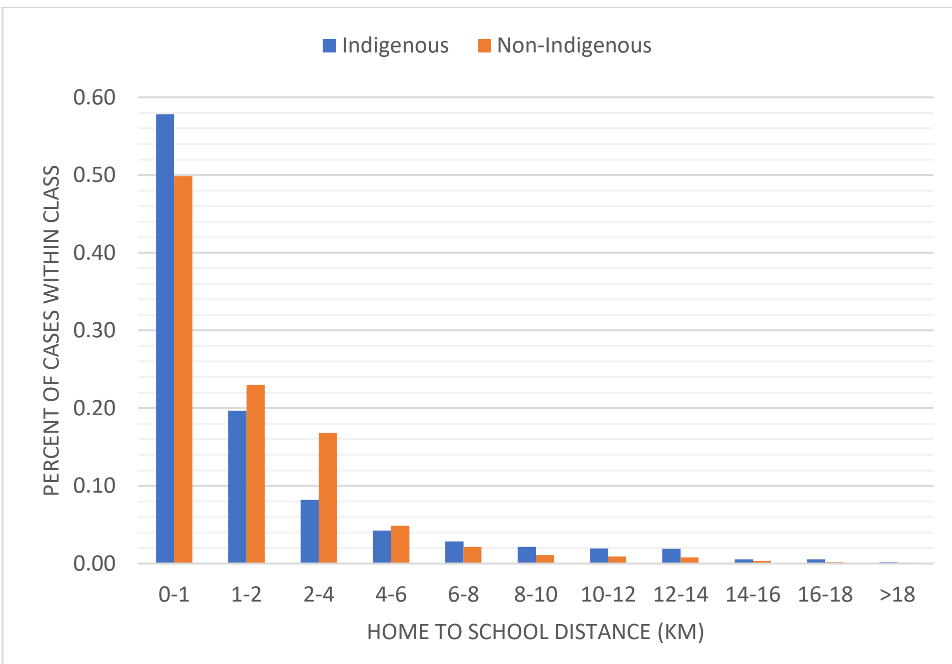


Table 7. *Linear Regression Estimates of School Trip Length*

	ln(d)	ln(d)	ln(d)	ln(d)
Indigenous	-0.02	0.15	-0.02	0.01
	(0.00)**	(0.00)**	(0.00)**	(0.00)*
Student Wealth Index	-0.06	-0.10	-0.01	-0.01
	(0.00)**	(0.00)**	(0.00)**	(0.00)**
Female	-0.00	-0.01	-0.01	-0.01
	(0.00)	(0.00)**	(0.00)**	(0.00)**
Child Worker	0.00	0.01	-0.01	-0.01
	(0.00)	(0.00)**	(0.00)	(0.00)
Age	0.02	0.02	0.01	0.02
	(0.00)**	(0.00)**	(0.00)**	(0.00)**
Motor disability	-0.12	-0.13	-0.08	-0.08
	(0.06)*	(0.05)*	(0.05)	(0.05)
Mixed (ref. public)	0.18	0.15	0.17	0.17
	(0.01)**	(0.01)**	(0.01)**	(0.01)**
Private	0.50	0.10	0.16	0.16
	(0.01)**	(0.01)**	(0.01)**	(0.01)**
Micro (ref. walking)		0.83	0.96	0.91
		(0.01)**	(0.01)**	(0.01)**
Bus		1.06	1.12	1.07
		(0.01)**	(0.01)**	(0.01)**
Minibus		0.98	1.08	1.04
		(0.01)**	(0.00)**	(0.01)**
Trufi		1.02	1.06	1.00
		(0.03)**	(0.03)**	(0.03)**
Taxi		0.99	0.98	0.91
		(0.04)**	(0.04)**	(0.04)**
Car		1.07	0.94	0.84
		(0.02)**	(0.02)**	(0.02)**
Other		0.59	0.63	0.60
		(0.06)**	(0.06)**	(0.06)**
Distance to Center (meters)			0.00	0.00
			(0.00)**	(0.00)**
El Alto (ref. La Paz)				-0.18
				(0.01)**
Constant	6.54	6.33	5.75	5.76
	(0.01)**	(0.01)**	(0.01)**	(0.01)**
R^2	0.03	0.12	0.16	0.17
N	429,153	429,153	429,153	429,153

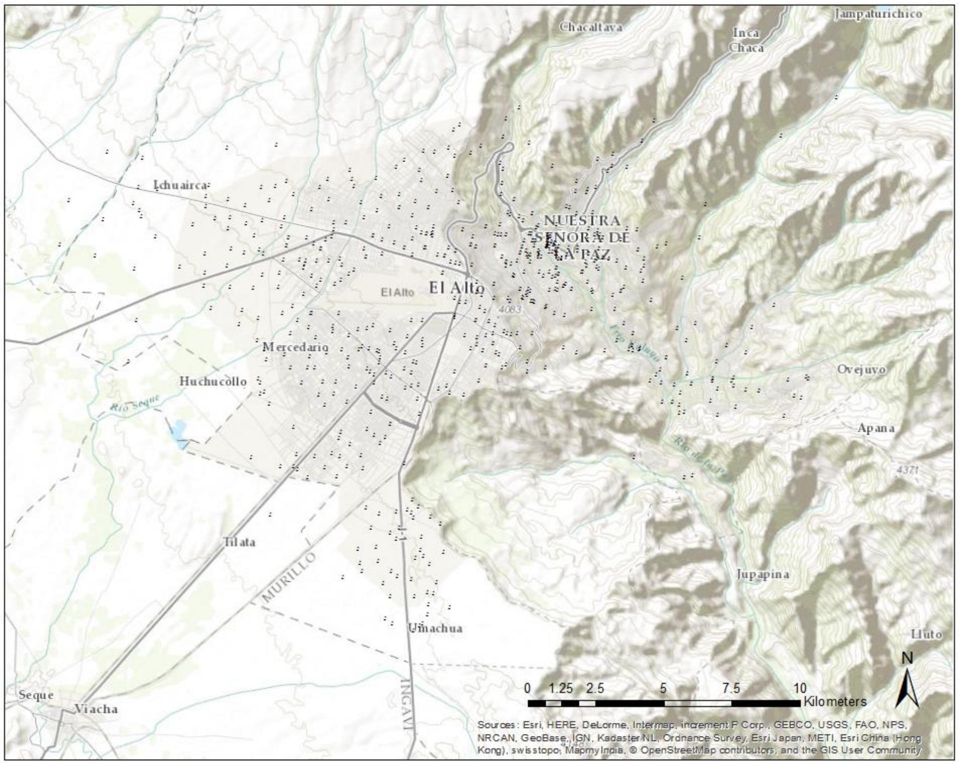
Notes: Coefficients estimated using OLS regression. Standard errors reported in parentheses. * p<0.05; ** p<0.01

Table 8. *Predicted School Trip Length by Student Profile*

Mobility Profile:	Walks		Minibus	
Lives in:	La Paz	El Alto	La Paz	El Alto
Predicted distance to school (ln)	6.54	6.36	7.58	7.40
Predicted distance to school (meters)	690	578	1,959	1,641
Indigenous	✓	✓	✓	✓
Student Wealth Index				
Lowest Tercile	✓	✓	✓	✓
School type				
Public	✓	✓	✓	✓
Mobility tool				
Walking	✓	✓		
Minibus			✓	✓
Distance to center (meters)				
La Paz	✓		✓	
El Alto		✓		✓

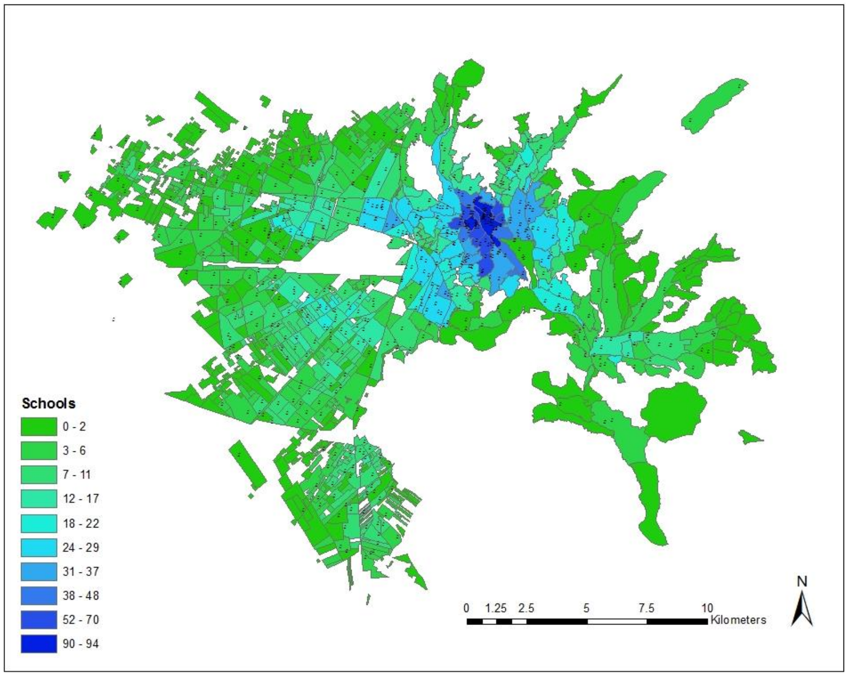
Notes: Number of observations=429,153.

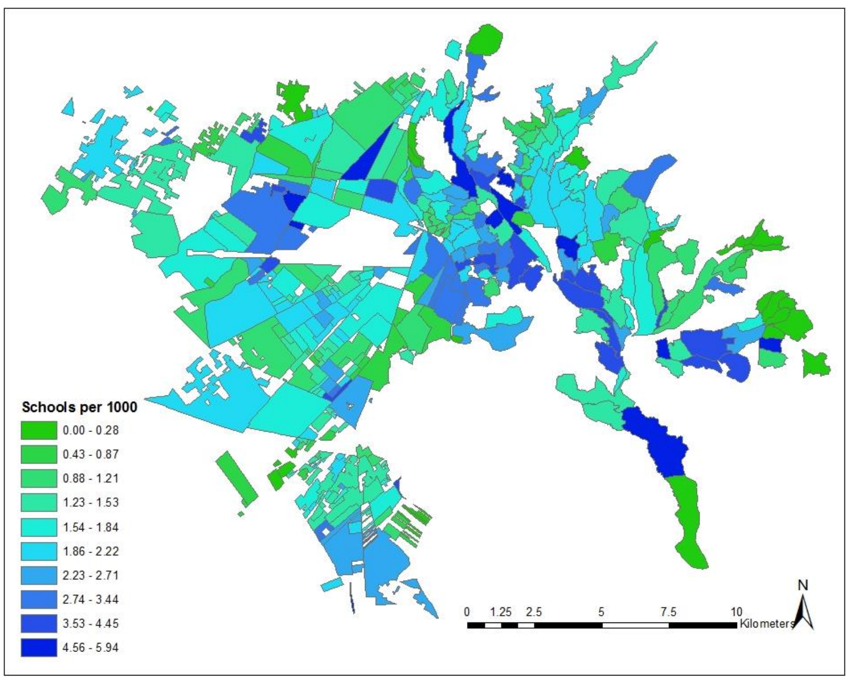
Figure 16. Distribution of schools in metropolitan La Paz-El Alto



Notes: Each flag represents a school of any kind. Source: Ministry of Education. Solid gray lines represent major roads. Dotted lines represent boundaries between municipalities.

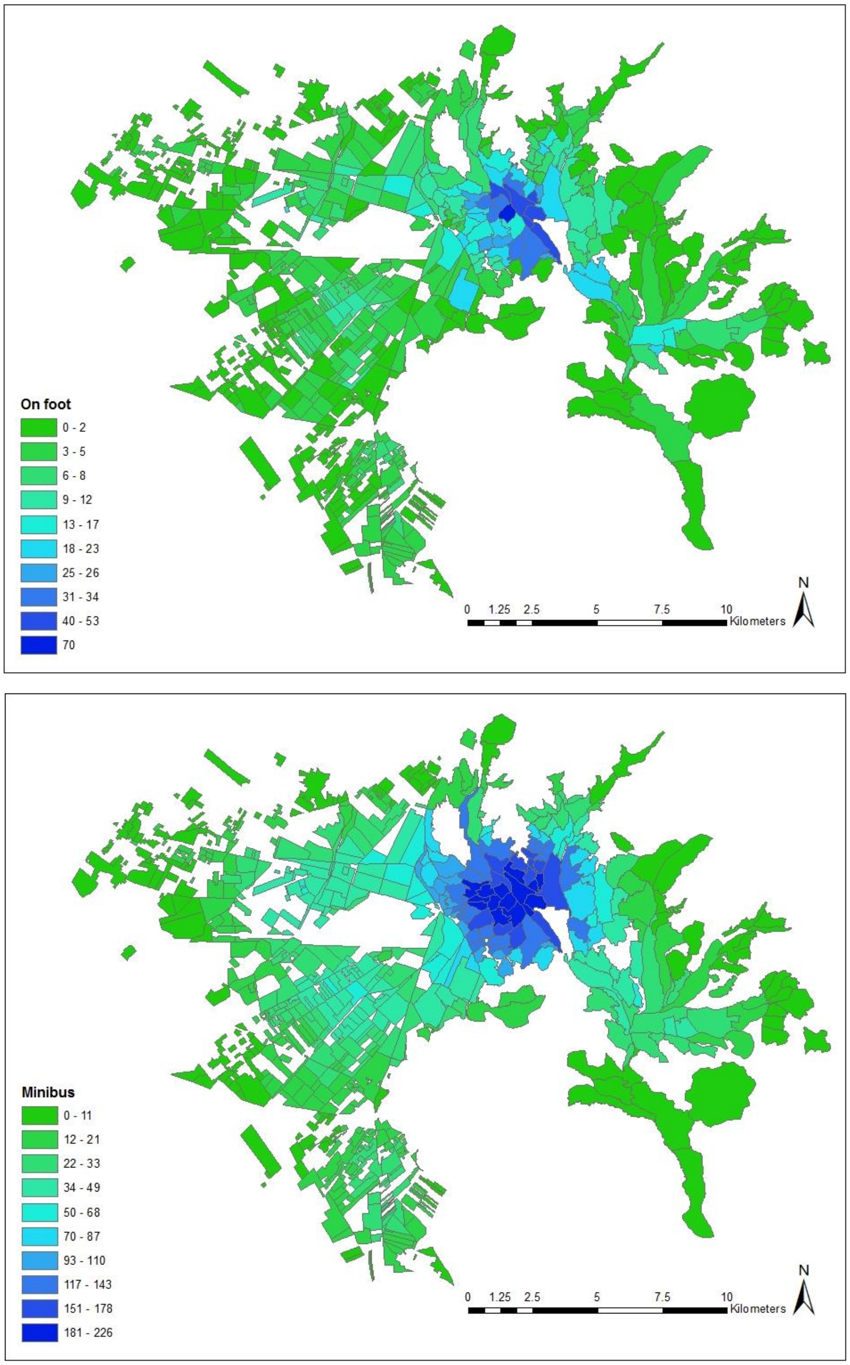
Figure 17. Normative cumulative educational opportunities indicator





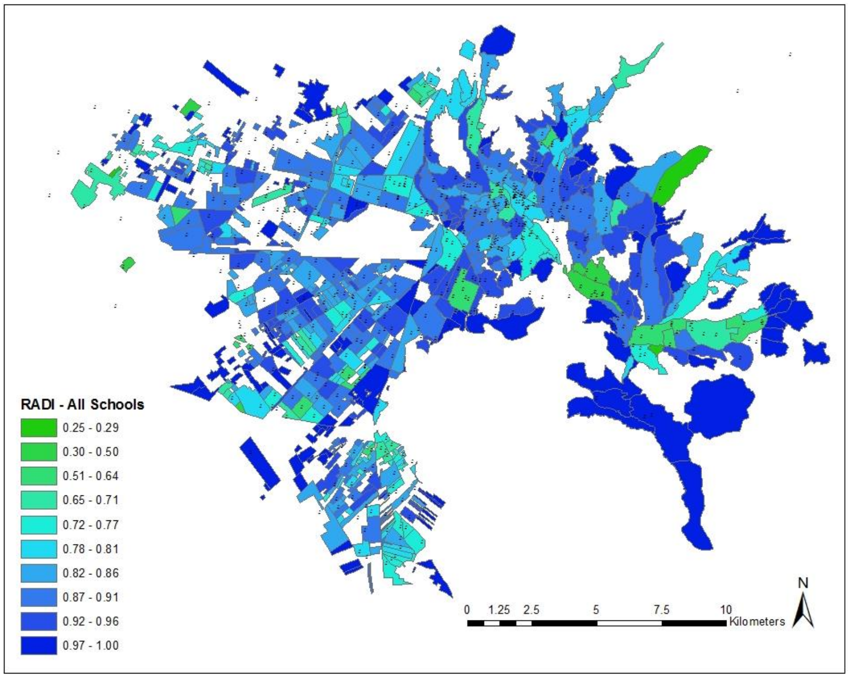
Notes: Total number of schools (top) and per 1000 students (bottom) within 869 meters of student residence.

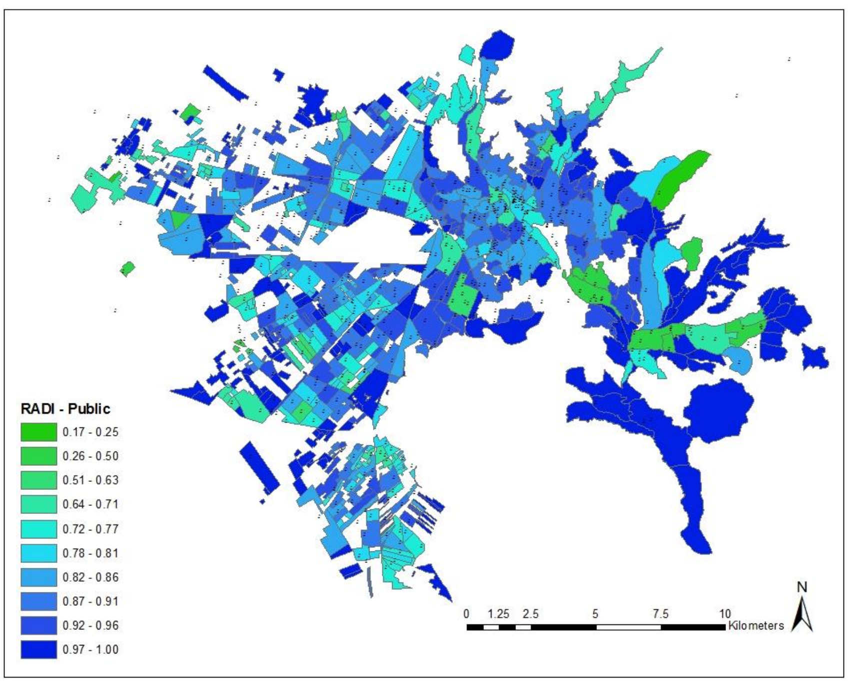
Figure 18. Cumulative educational opportunities for students by travel mode



Notes: Number of schools reachable on foot (top) and by minibus (bottom). Opportunity space is estimated for students who are Indigenous, come from the lowest wealth tercile, and attend public schools.

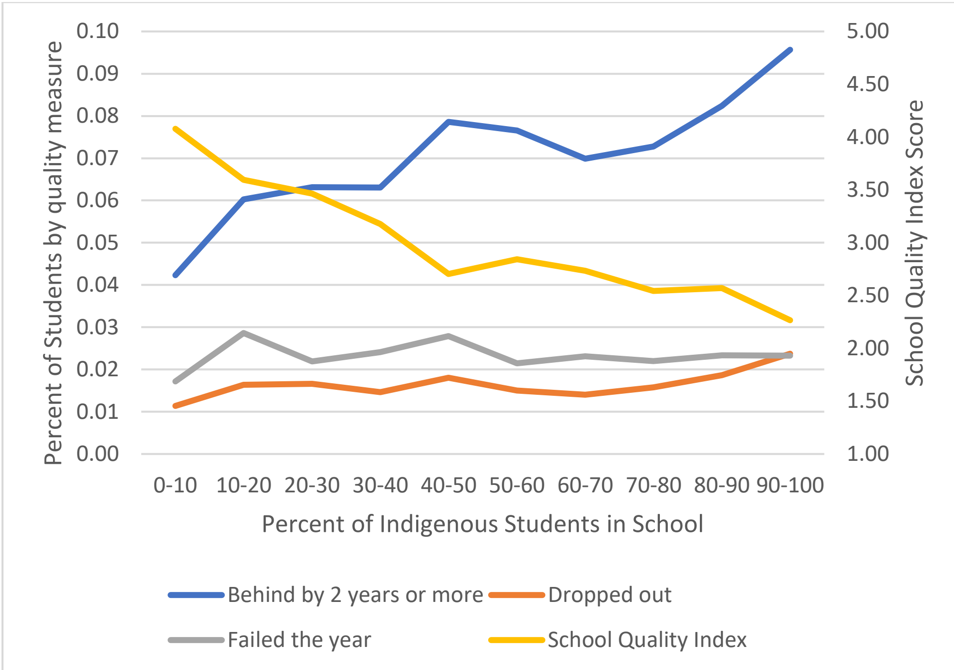
Figure 19. Relative accessibility deprivation index





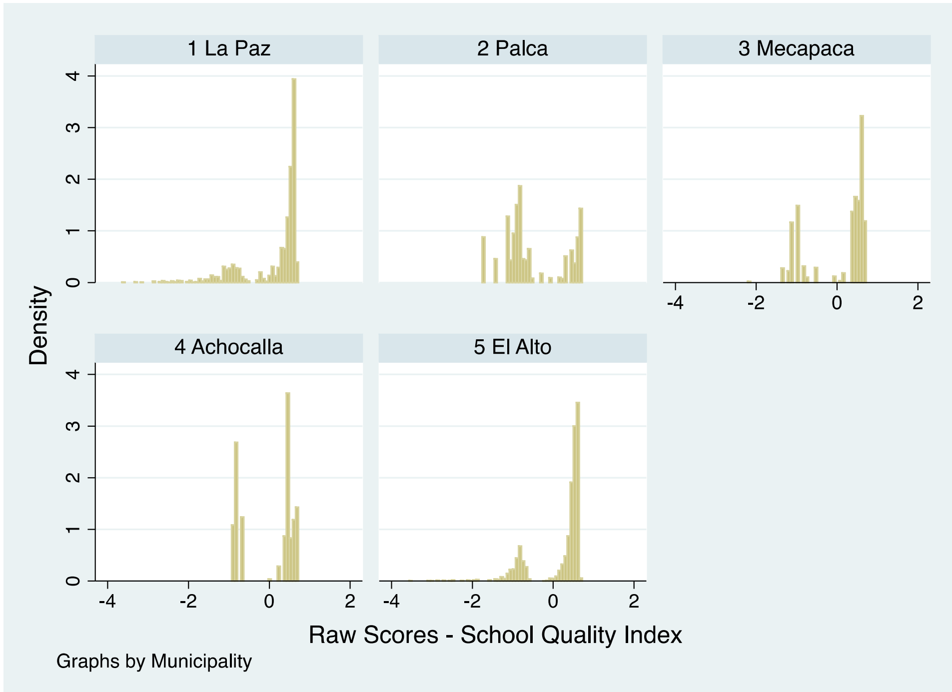
Notes: The relative accessibility deprivation index represents the proportion of schools out of reach on foot out of all schools reachable by minibus. Higher values indicate greater relative accessibility deprivation. The opportunity space is estimated for students who are Indigenous, come from the lowest wealth tercile, and attend public schools. Top figure shows the index for all schools; bottom figure for public schools only.

Figure 20. School quality and ethnic composition of schools



Notes: The School Quality Index (right axis) refers a composite factor that includes the share of students who dropped out, the share that failed the year, and the share of students who are behind by two years or more, with an Eigenvalue of 1.12 (Number of students= 487,337; number of schools=1,110). The performance measure was aggregated at the school level and divided in quintiles.

Figure 21. Distribution of quality schools across the metropolitan area



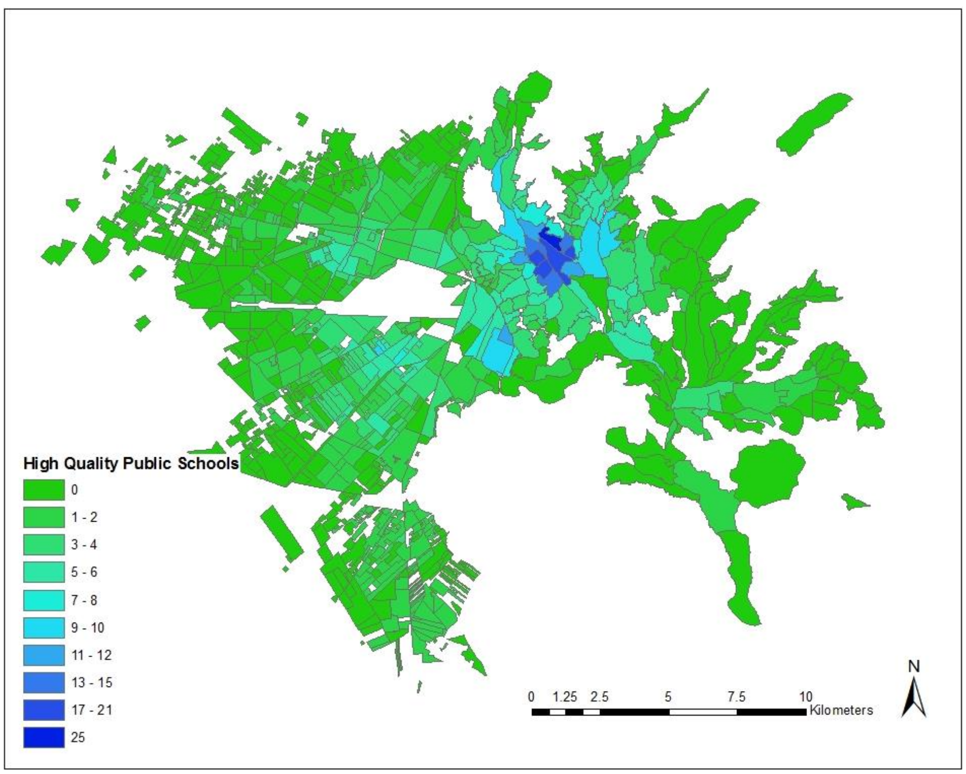
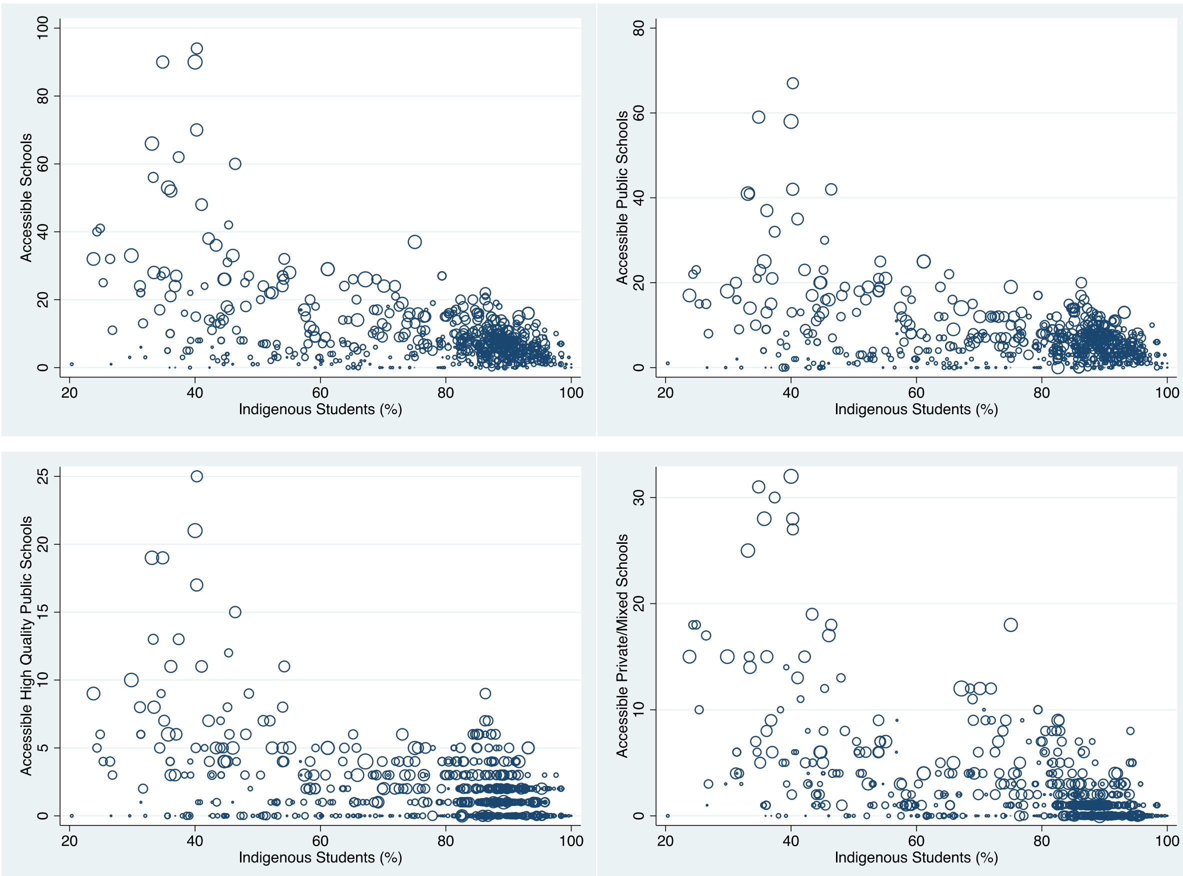


Figure 22. School accessibility and share of Indigenous students by neighborhood



Notes: A school accessible if it is within 869 meters of the centroid of the neighborhood where a student lives. The size of the markers represents the size of the student population living in each neighborhood. High quality public schools scored at the highest tercile of a school quality index based on the proportion of students who passed the year and the proportion of students who are behind in school by two years or more. Number of neighborhoods=717.

Table 9. *School Accessibility and Residential Segregation Based on Ethnicity*

	Schools	Schools	Schools	Schools
Indigenous Students (%)	-0.25 (0.02)**	-0.17 (0.01)**	-0.14 (0.02)**	-0.21 (0.03)**
Population Size (1000s)		1.63 (0.08)**	1.55 (0.09)**	1.28 (0.08)**
Distance to Center (km)			-0.21 (0.12)*	-0.73 (0.19)**
El Alto - 1 (ref. Center)				-30.27 (2.97)**
El Alto - 2				-27.25 (3.08)**
El Alto - 3				-25.58 (3.08)**
El Alto - 4				-22.53 (3.16)**
El Alto - 5				-28.22 (3.15)**
El Alto - 6				-28.29 (3.21)**
El Alto - 7				-20.88 (3.56)**
El Alto - 8				-23.18 (3.32)**
El Alto - 12				-22.86 (3.48)**
El Alto - 13				-43.70 (7.07)**
El Alto - 14				-24.93 (3.37)**
El Alto - Tilata				-24.65 (7.06)**
La Paz - Cotahuma				-24.40 (2.87)**
La Paz - Hampaturi				-28.90 (6.85)**
La Paz - Hampauri				-25.37 (6.88)**
La Paz - Mallasa				-32.29 (3.68)**
La Paz - Max Paredes				-32.72 (2.85)**
La Paz - Periferica				-31.14 (2.76)**
La Paz - San Antonio				-37.00 (2.96)**
La Paz - Sur				-32.58 (2.94)**
Constant	28.13 (1.47)**	14.21 (1.31)**	14.44 (1.32)**	51.43 (2.92)**
R^2	0.21	0.52	0.52	0.66
N	717	717	717	717

Table 10. *School Accessibility and Ethnic Residential Segregation by School Type*

	Schools	Public	Private or Mixed	High Quality Public
Indigenous Students (%)	-0.21	-0.09	-0.11	-0.04
	(0.03)**	(0.02)**	(0.01)**	(0.01)**
Population Size (1000s)	1.28	0.88	0.40	0.29
	(0.08)**	(0.06)**	(0.04)**	(0.02)**
Distance to Center (km)	-0.73	-0.64	-0.09	-0.26
	(0.19)**	(0.13)**	(0.08)	(0.05)**
El Alto - 1 (ref. Center)	-30.27	-18.52	-11.75	-6.53
	(2.97)**	(2.09)**	(1.30)**	(0.85)**
El Alto - 2	-27.25	-16.78	-10.47	-5.54
	(3.08)**	(2.17)**	(1.35)**	(0.89)**
El Alto - 3	-25.58	-16.25	-9.33	-5.24
	(3.08)**	(2.17)**	(1.35)**	(0.89)**
El Alto - 4	-22.53	-14.79	-7.74	-5.16
	(3.16)**	(2.22)**	(1.39)**	(0.91)**
El Alto - 5	-28.22	-18.07	-10.14	-6.59
	(3.15)**	(2.22)**	(1.38)**	(0.91)**
El Alto - 6	-28.29	-20.04	-8.25	-7.97
	(3.21)**	(2.26)**	(1.41)**	(0.92)**
El Alto - 7	-20.88	-12.46	-8.42	-4.51
	(3.56)**	(2.50)**	(1.56)**	(1.02)**
El Alto - 8	-23.18	-13.43	-9.75	-5.11
	(3.32)**	(2.34)**	(1.46)**	(0.96)**
El Alto - 12	-22.86	-14.37	-8.49	-5.22
	(3.48)**	(2.45)**	(1.53)**	(1.00)**
El Alto - 13	-43.70	-24.83	-18.87	-8.64
	(7.07)**	(4.97)**	(3.10)**	(2.03)**
El Alto - 14	-24.93	-15.50	-9.43	-5.85
	(3.37)**	(2.37)**	(1.48)**	(0.97)**
El Alto - Tilata	-24.65	-15.42	-9.24	-4.99
	(7.06)**	(4.96)**	(3.10)**	(2.03)**
La Paz - Cotahuma	-24.40	-17.07	-7.33	-7.04
	(2.87)**	(2.02)**	(1.26)**	(0.82)**
La Paz - Hampaturi	-28.90	-19.33	-9.57	-7.03
	(6.85)**	(4.82)**	(3.01)**	(1.97)**
La Paz - Hampauri	-25.37	-16.31	-9.06	-6.63
	(6.88)**	(4.84)**	(3.02)**	(1.98)**
La Paz - Mallasa	-32.29	-20.19	-12.09	-6.83
	(3.68)**	(2.58)**	(1.61)**	(1.06)**
La Paz - Max Paredes	-32.72	-21.00	-11.71	-8.30
	(2.85)**	(2.01)**	(1.25)**	(0.82)**
La Paz - Periferica	-31.14	-18.83	-12.30	-6.44
	(2.76)**	(1.94)**	(1.21)**	(0.79)**
La Paz - San Antonio	-37.00	-23.83	-13.17	-8.34
	(2.96)**	(2.08)**	(1.30)**	(0.85)**
La Paz - Sur	-32.58	-21.09	-11.50	-7.31
	(2.94)**	(2.07)**	(1.29)**	(0.85)**
Constant	51.43	31.59	19.85	11.38
	(2.92)**	(2.05)**	(1.28)**	(0.84)**
R^2	0.66	0.62	0.59	0.56
N	717	717	717	717

Table 11. *Origin-Destination Matrix for El Alto Residents Who Attend School in La Paz*

	Origin District in El Alto										
Destination District in La Paz	1	2	3	4	5	6	7	8	12	14	Total
CENTRO	0.56	0.35	0.31	0.55	0.36	0.14	0.17	0.08	0.21	0.41	0.25
COTAHUMA	0.21	0.07	0.08	0.11	0.08	0.02	0.07	0.02	0.16	0.06	0.07
HAMPATURI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAMPAURI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALLASA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAX PAREDES	0.07	0.07	0.22	0.18	0.46	0.80	0.46	0.50	0.48	0.18	0.42
PERIFERICA	0.14	0.26	0.10	0.12	0.04	0.03	0.07	0.20	0.14	0.14	0.12
SAN ANTONIO	0.01	0.04	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01
SUR	0.01	0.22	0.29	0.02	0.07	0.00	0.22	0.19	0.01	0.20	0.12
Total	1,514	709	1,230	260	562	2,323	888	2,274	137	93	9,990

Table 12. *Origin-Destination Matrix for La Paz Residents Who Attend School in El Alto*

	Origin District in La Paz									
Destination District in El Alto	CENT.	COT.	HMT	HMP	MAL	MAX	PER	SAN	SUR	Total
1	0.22	0.95	0	0	0	0.15	0.07	0.16	0.13	0.41
2	0.14	0.00	0	0	0	0.05	0.06	0.40	0.02	0.05
3	0.02	0.01	0	0	0	0.14	0.16	0.09	0.02	0.08
4	0.01	0.00	0	0	0	0.02	0.01	0.02	0.01	0.01
5	0.01	0.00	0	0	0	0.04	0.15	0.07	0.02	0.06
6	0.04	0.01	0	0	0	0.30	0.03	0.04	0.02	0.08
7	0.28	0.01	0	0	0	0.02	0.06	0.00	0.08	0.04
8	0.28	0.00	0	0	0	0.13	0.37	0.22	0.67	0.20
12	0.01	0.00	0	0	0	0.15	0.09	0.00	0.00	0.06
14	0.01	0.00	0	0	0	0.01	0.00	0.01	0.03	0.01
Total	199	1,708	0	0	0	972	1,455	192	330	4,856

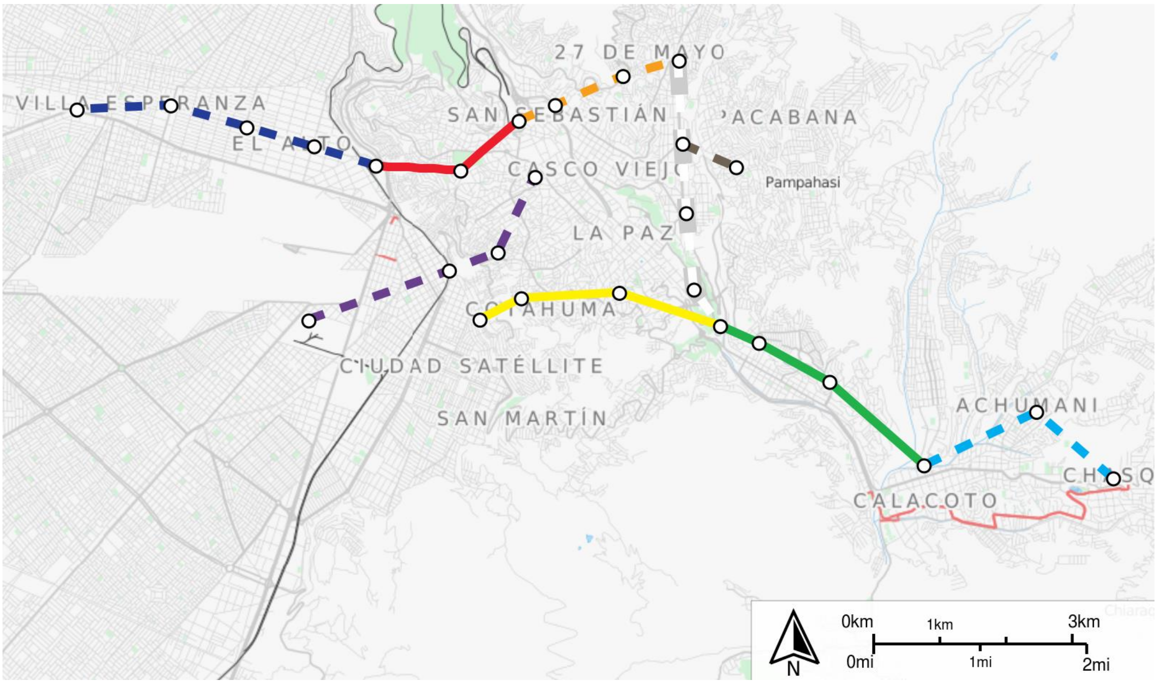
Notes: These tables are constructed using the district of residence of the student as the point of origin and the district of the school where student is enrolled as the point of destination. Each cell contains the share of students from a given district of origin who commutes to a district of the neighboring in 2014.

Table 13. *Neighborhoods Ranked by Origins and Destinations of Students*

A. Top Neighborhoods of Origin			B. Top Destination Neighborhoods		
City	Name	Count	City	School Zones	Count
EL ALTO	ALTO LIMA 1	9,787	LA PAZ	CENTRAL	17,443
LA PAZ	MIRAFLORES	9,289	EL ALTO	RIO SECO	13,392
EL ALTO	EL INGENIO D1	8,176	EL ALTO	VILLA 16 DE JULIO	12,656
EL ALTO	COSMOS 79 U.V. "A"	7,665	EL ALTO	CIUDAD SATELITE	9,379
EL ALTO	VILLA 16 DE JULIO	7,290	LA PAZ	EL ROSARIO	8,792
EL ALTO	GERMAN BUSCH	7,228	LA PAZ	MIRAFLORES	8,103
EL ALTO	HUAYNA POTOSI	6,826	EL ALTO	BALLIVIAN 1	7,862
EL ALTO	BAUTISTA SAAVEDRA	6,801	LA PAZ	SOPOCACHI	7,432
EL ALTO	CHARAPAQUI	6,729	EL ALTO	VILLA DOLORES	7,342
LA PAZ	SAN PEDRO	6,566	EL ALTO	VILLA BOLIVAR	7,196
EL ALTO	BALLIVIAN 1	6,085	EL ALTO	COSMOS 79 U.V. "A"	6,738
EL ALTO	CIUDAD SATELITE	5,979	LA PAZ	CALACOTO	5,907
EL ALTO	VILLA TUNARI	5,924	EL ALTO	BAUTISTA SAAVEDRA	5,575
LA PAZ	SAN ANTONIO	5,861	EL ALTO	MARISCAL SUCRE	5,418
LA PAZ	SOPOCACHI	5,790	EL ALTO	VILLA MERCEDES	5,234
EL ALTO	VILLA BOLIVAR	5,544	EL ALTO	HUAYNA POTOSI	5,195
EL ALTO	RIO SECO	5,519	EL ALTO	ALTO LIMA 2	5,180
EL ALTO	SENKATA	5,151	EL ALTO	GERMAN BUSCH	5,116
LA PAZ	PAMPAHASI	5,021	LA PAZ	SAN SEBASTIAN	5,093
LA PAZ	VILLA FATIMA	4,802	LA PAZ	ZONA NORTE	5,068

Notes: The total number of students enrolled in schools in this year was 428,806.

Figure 23. Routes of the cable car system



Notes: Thick, solid lines represent the cable car lines that have already been completed. Dotted lines are under construction. Each bubble marker represents a station.

Table 14. *Relative Cost of Cable Car per Trip*

Line	Red	Yellow	Green	Yellow-Green
Launching	Mar. 2014	Dec. 2014	Dec. 2014	Dec. 2014
Distance (meters):				
Euclidian	2,310	3,740	3,590	7,050
Cable car	2,349	3,883	3,732	7,615
Network	6,100	8,300	4,800	13,500
Travel time (minutes)				
Cable car	11	17	17	34
Minibus	46	65	21	86
Car	33	28	15	35
On foot	51	90	90	120
Student fare (Bs.):				
Cable car	1.50	1.50	1.50	2.50
Minibus	4.00	5.50	2.00	6.60
Taxi	12.00	20.00	12.00	30.00
Ratio (cable car/minibus)				
Distance	0.39	0.47	0.78	0.56
Travel time	0.24	0.26	0.81	0.40
Ticket cost	0.38	0.27	0.75	0.38

Notes: Cable car data comes from the “Empresa Estatal de Transporte por Cable “MiTeleferico.” Euclidian and network distances and travel times are estimated using Google Earth. Costs per trip are estimated with data from Gobierno Autónomo Municipal de La Paz (2015)

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Table 15. *Monthly Income and Transportation Expense (Bs.)*

	Income	Transportation Expense	Share
Metropolitan area	758.40	101.63	0.13
La Paz	1542.70	100.28	0.07
El Alto	650.10	113.77	0.18
Other	534.00	95.05	0.18
High-income	1377.80	125.38	0.09
Middle income	844.10	106.36	0.13
Low-income	613.70	93.28	0.15

Source: Gobierno Autónomo Municipal de La Paz (GAMLP), 2015.

Figure 24. Change in disposable income as a function of transport cost saving

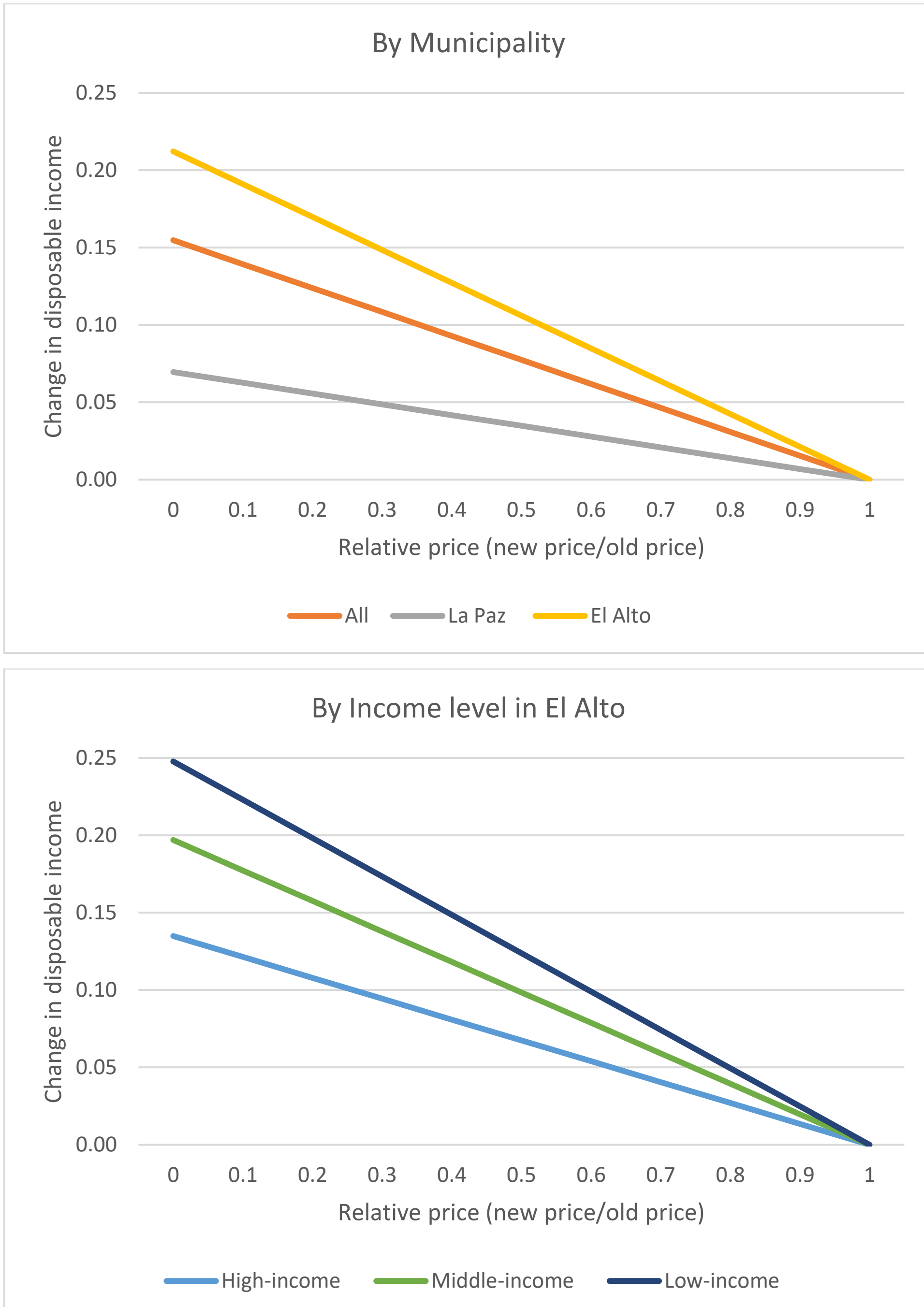


Table 16. *Summary Statistics for El Alto Residents* (*N* = 661,059)

Variables	n	Mean	Std. Dev.	Min	Max
Transition years:					
2012-2013 (pre treatment)	205,368	0.31	0.46	0	1
2013-2014 (pre treatment)	225,882	0.34	0.47	0	1
2014-2015 (post treatment)	229,809	0.35	0.48	0	1
Continuous Treatment:					
Ln(Distance)	661,059	8.4084	0.7380	4.41	9.51
Distance (neighborhood to station) in meters	661,059	5,533	3,031	82	13,521
Outcomes at time t+1					
1) Holds student card for the cable cars	2,449	0.0037	0.0608	0	1
2) Switched to school in La Paz	2,500	0.0038	0.0614	0	1
2.1) Switched to Public School in La Paz	1,524	0.0023	0.0480	0	1
2.2) Switched to Private School in La Paz	768	0.0012	0.0341	0	1
2.3) Switched to Mixed School in La Paz	208	0.0003	0.0177	0	1
Individual level controls:					
Female	326,048	0.49	0.50	0	1
Indigenous	539,356	0.82	0.39	0	1
Age	661,059	10.57	3.66	3	22
Worker	206,179	0.31	0.46	0	1
Wealth Index	661,059	1.87	0.79	1	3
Motor Disability	649	0.00	0.03	0	1
Behind by 2 years or more	39,272	0.06	0.24	0	1
Walked to school at time *t*	577,212	0.87	0.33	0	1
School level controls:					
Diff. in School Quality Index	661,059	-0.08	0.80	-4	4
Diff. in School Ethnic Composition	661,059	0.16	0.68	-4	4
Diff. in School Wealth Index	661,059	0.07	0.76	-4	4
Diff. in School Population Size	661,059	-6.58	190.93	-3,673	3,810

Notes: The table includes data for El Alto residents who were enrolled in schools in 2012, 2013 or 2014 and then enrolled in schools of the metropolitan area in the following years 2013, 2014 or 2015, respectively. The original dataset included 668,207 observations, excluding students who graduated, dropped out, or emigrated in each transition. The dataset includes geographic coordinates for the neighborhoods of 661,059 students (99 percent). Distance represents the number of meters from the centroid of students' neighborhoods of residence to the closet cable car station. The bottom four rows show school-level controls that capture the difference in school quality, share of Indigenous students, mean student wealth, and student body size between students' old and new schools. Data source: Bolivian Ministry of Education's RUDE (*Registro Único de Estudiantes*) for the years 2012-2015.

Figure 25. Outcome variables by distance to closest station

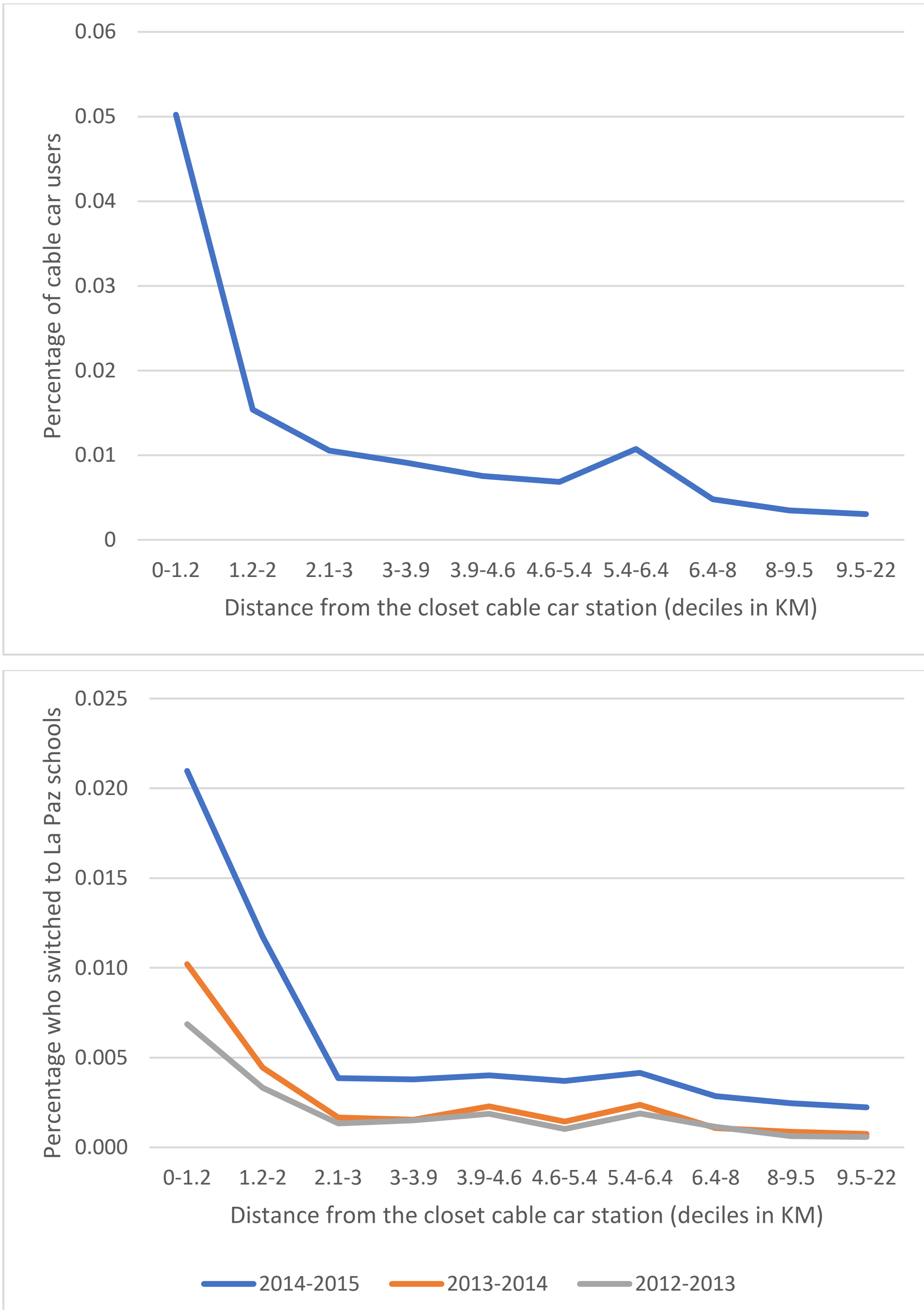


Table 17. *Effect of Transit Availability on Holding a Student Card*

	Card holder	Card holder	Card holder
Ln(distance)	-0.0132	-0.0110	-0.0107
	(0.0019)***	(0.0019)***	(0.0018)***
Age		0.0020	0.0020
		(0.0002)***	(0.0002)***
Female		-0.0001	-0.0001
		(0.0005)	(0.0005)
Indigenous		-0.0157	-0.0160
		(0.0025)***	(0.0025)***
Wealth Index		0.0013	0.0014
		(0.0006)**	(0.0006)**
Motor Disability		0.0042	0.0045
		(0.0068)	(0.0069)
Behind by 2+ years		-0.0153	-0.0154
		(0.0017)***	(0.0017)***
Diff. in School Quality			0.0017
			(0.0005)***
Diff. in Ethnic Composition			-0.0042
			(0.0010)***
Diff. in Mean School Wealth			0.0014
			(0.0012)
Diff. in Student Pop. Size			0.0000
			(0.0000)*
Constant	0.1220	0.0933	0.0912
	(0.0172)***	(0.0162)***	(0.0156)***
R^2	0.01	0.02	0.02
N	229,809	229,809	229,809

Notes: The table reports a linear-probability model estimate of the effects of mass transit availability on the probability that El Alto residents will hold a student ID card from the cable car company, which gives them 50% discount on every ticket. The treatment "ln(distance)" captures the natural log of the distance from the students' neighborhood of residence to the closest cable car station at the time that the cable car service was available (2015). Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Table 18. *Effect of Cable Car Availability on Switching to a School in La Paz*

	Switch	Switch	Switch
Ln(distance)	-0.0019	-0.0017	-0.0010
	(0.0003)***	(0.0003)***	(0.0004)**
2013-2014	0.0095	0.0092	0.0080
	(0.0052)*	(0.0052)*	(0.0065)
2014-2015	0.0335	0.0331	0.0335
	(0.0049)***	(0.0049)***	(0.0054)***
2013-2014 x ln(distance)	-0.0011	-0.0010	-0.0010
	(0.0006)*	(0.0006)*	(0.0007)
2014-2015 x ln(distance)	-0.0034	-0.0033	-0.0034
	(0.0006)***	(0.0006)***	(0.0006)***
Age		0.0000	-0.0000
		(0.0000)	(0.0001)
Female		-0.0003	-0.0002
		(0.0002)**	(0.0002)
Indigenous		-0.0019	-0.0022
		(0.0005)***	(0.0006)***
Wealth Index		0.0001	0.0001
		(0.0001)	(0.0002)
Motor Disability		0.0004	0.0007
		(0.0026)	(0.0026)
Behind by 2+ years		0.0014	0.0014
		(0.0004)***	(0.0004)***
Diff. in School Quality			-0.0016
			(0.0005)***
Diff. in Ethnic Composition			-0.0101
			(0.0007)***
Diff. in Mean School Wealth			0.0011
			(0.0006)*
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.0176	0.0177	0.0139
	(0.0024)***	(0.0027)***	(0.0036)***
R^2	0.00	0.00	0.02
N	661,059	661,059	661,059

Notes: The table reports a linear-probability model estimate of the effects of mass transit availability on the probability that El Alto residents, who are enrolled in schools of El Alto at time *t*, switch to a school in La Paz at time *t*+1. The treatment "2014-2015 x ln(distance)" captures the natural log of the distance from the students' neighborhood of residence to the closest cable car station at the time that the cable car service was available. Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Table 19. *Effect of Mass Transit on Switching to Schools in La Paz by School Type*

	Public	Mixed	Private
Ln(Distance)	-0.0001	-0.0003	-0.0006
	(0.0003)	(0.0001)**	(0.0002)**
2013-2014	0.0099	-0.0017	-0.0002
	(0.0055)*	(0.0014)	(0.0022)
2014-2015	0.0234	0.0007	0.0094
	(0.0042)***	(0.0013)	(0.0029)***
2013-2014 x ln(distance)	-0.0012	0.0002	0.0000
	(0.0006)*	(0.0002)	(0.0003)
2014-2015 x ln(distance)	-0.0024	-0.0000	-0.0010
	(0.0005)***	(0.0002)	(0.0003)***
Age	-0.0001	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)
Female	-0.0004	-0.0001	0.0002
	(0.0001)***	(0.0000)	(0.0001)**
Indigenous	-0.0006	-0.0001	-0.0016
	(0.0004)	(0.0001)	(0.0004)***
Wealth Index	-0.0001	0.0000	0.0001
	(0.0001)	(0.0000)	(0.0001)*
Motor Disability	0.0001	-0.0003	0.0008
	(0.0022)	(0.0001)***	(0.0015)
Behind by 2+ years	0.0021	0.0000	-0.0007
	(0.0004)***	(0.0001)	(0.0002)***
Diff. in School Quality	-0.0020	0.0003	0.0002
	(0.0004)***	(0.0001)***	(0.0002)
Diff. in Ethnic Composition	-0.0060	-0.0008	-0.0032
	(0.0005)***	(0.0001)***	(0.0006)***
Diff. in Mean School Wealth	-0.0001	0.0003	0.0008
	(0.0004)	(0.0001)***	(0.0004)**
Diff. in Student Pop. Size	-0.0000	-0.0000	0.0000
	(0.0000)***	(0.0000)***	(0.0000)***
Constant	0.0040	0.0029	0.0070
	(0.0022)*	(0.0012)**	(0.0021)***
R^2	0.01	0.00	0.01
N	661,059	661,059	661,059

Notes: The table reports a linear-probability model estimate of the effects of mass transit availability on the probability that El Alto residents, who are enrolled in schools of El Alto at time *t*, switch to different types of school in La Paz at time *t*+1. The treatment "2014-2015 x ln(distance)" captures the natural log of the distance from the students' neighborhood of residence to the closest cable car station at the time that the cable car service was available. Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Figure 26. Predicted probability of holding student card

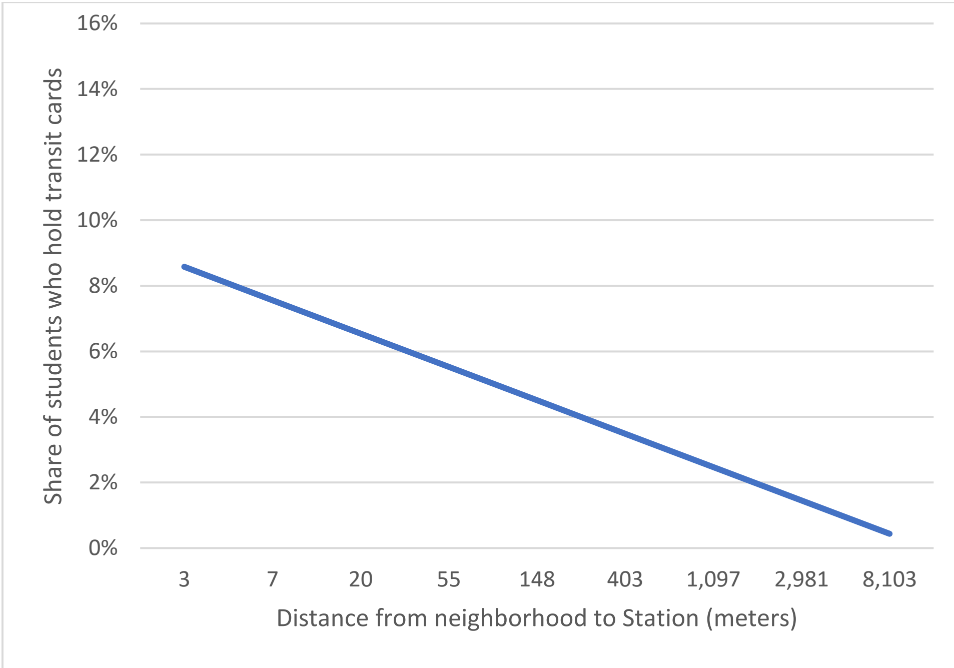


Figure 27. Predicted probability of switching to schools in La Paz

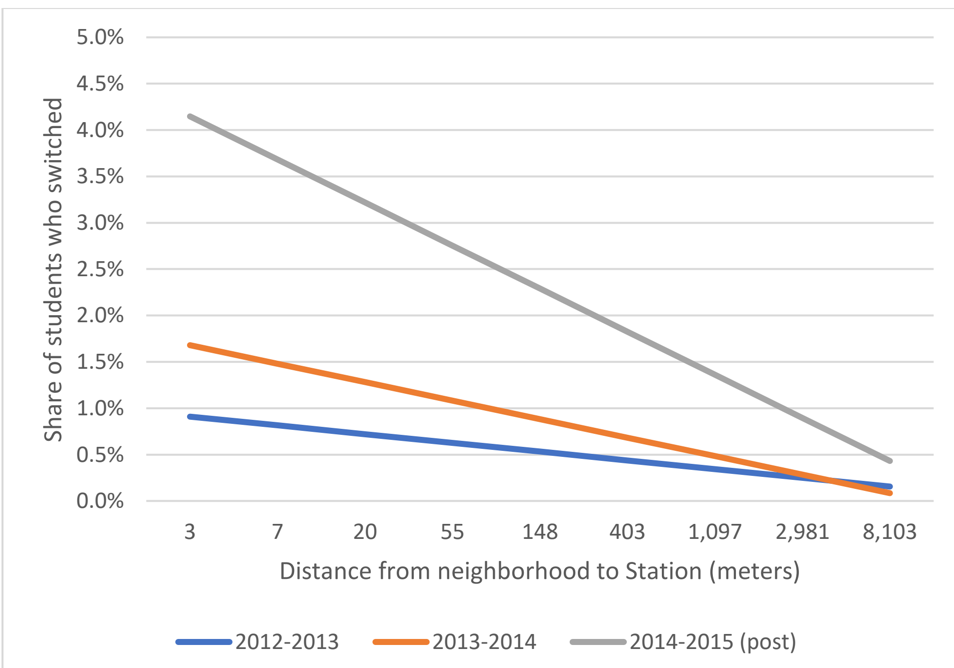


Table 20. *Effect of Mass Transit on Holding Transit Card by Ethnicity*

	Cable Car User	Cable Car User	Cable Car User
Ln(Distance)	-0.0198	-0.0197	-0.0196
	(0.0033)***	(0.0034)***	(0.0034)***
Indigenous	-0.1053	-0.1112	-0.1140
	(0.0124)***	(0.0120)***	(0.0125)***
Indigenous x Ln(Distance)	0.0109	0.0116	0.0120
	(0.0014)***	(0.0014)***	(0.0014)***
Age		0.0020	0.0020
		(0.0003)***	(0.0003)***
Female		-0.0001	-0.0001
		(0.0004)	(0.0004)
Wealth Index		0.0015	0.0016
		(0.0005)***	(0.0005)***
Motor Disability		0.0043	0.0047
		(0.0056)	(0.0057)
Behind by 2+ years		-0.0153	-0.0153
		(0.0025)***	(0.0025)***
Diff. in School Quality			0.0016
			(0.0004)***
Diff. in Ethnic Composition			-0.0044
			(0.0011)***
Diff. in Mean School Wealth			0.0015
			(0.0007)**
Diff. in Student Pop. Size			0.0000
			(0.0000)**
Constant	0.1880	0.1630	0.1625
	(0.0286)***	(0.0284)***	(0.0280)***
R^2	0.01	0.02	0.02
N	229,809	229,809	229,809

* p<0.1; ** p<0.05; *** p<0.01

Table 21. *Effect of Mass Transit on Holding Student Card by Wealth Status*

	Cable Car User	Cable Car User	Cable Car User
Ln(Distance)	-0.0114	-0.0107	-0.0102
	(0.0032)***	(0.0032)***	(0.0031)***
2nd Wealth Tercile	-0.0307	-0.0342	-0.0304
	(0.0245)	(0.0237)	(0.0237)
3rd Wealth Tercile	0.0874	0.0760	0.0786
	(0.0331)***	(0.0321)**	(0.0318)**
2nd Wealth Tercile x Ln(Distance)	0.0034	0.0038	0.0034
	(0.0027)	(0.0026)	(0.0026)
3rd Wealth Tercile x Ln(Distance)	-0.0093	-0.0087	-0.0089
	(0.0037)**	(0.0036)**	(0.0036)**
Age		0.0018	0.0018
		(0.0002)***	(0.0002)***
Female		-0.0000	-0.0000
		(0.0005)	(0.0005)
Indigenous		-0.0157	-0.0160
		(0.0024)***	(0.0024)***
Motor Disability		0.0045	0.0048
		(0.0068)	(0.0068)
Behind by 2+ years		-0.0149	-0.0150
		(0.0017)***	(0.0017)***
Diff. in School Quality			0.0014
			(0.0005)***
Diff. in Ethnic Composition			-0.0042
			(0.0010)***
Diff. in Mean School Wealth			0.0013
			(0.0012)
Diff. in Student Pop. Size			0.0000
			(0.0000)*
Constant	0.1050	0.0963	0.0921
	(0.0292)***	(0.0267)***	(0.0261)***
R^2	0.01	0.02	0.02
N	229,809	229,809	229,809

Figure 28. Predicted probability of holding transit card by wealth

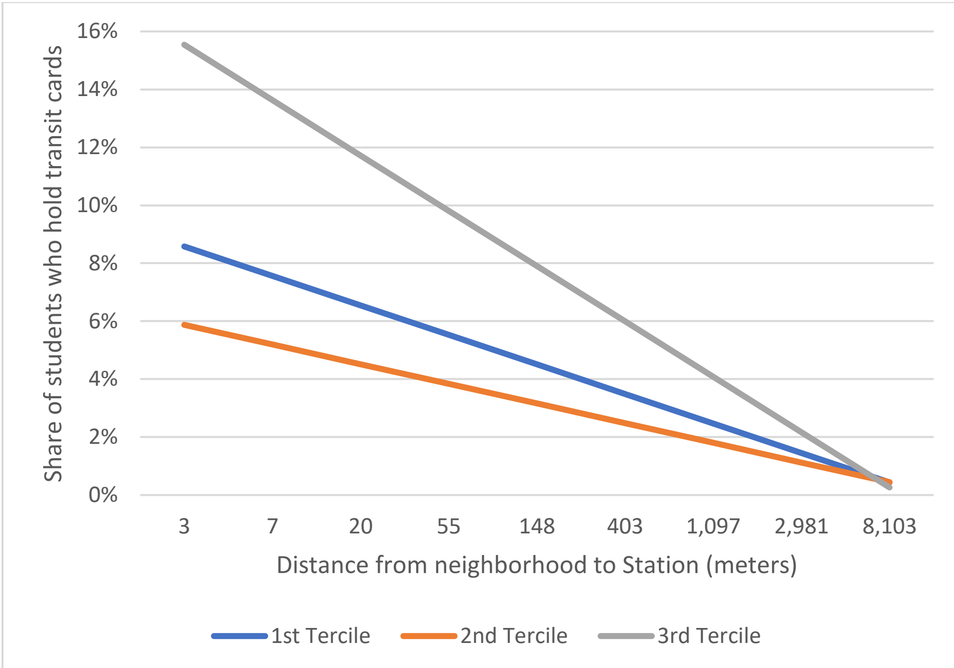


Table 22. *Effect of Mass Transit on Switching to Schools in La Paz by Ethnicity*

	Switch	Switch	Switch
Ln(Distance)	-0.0023	-0.0023	-0.0019
	(0.0006)***	(0.0009)***	(0.0008)**
2013-2014	0.0039	0.0039	0.0015
	(0.0049)	(0.0035)	(0.0045)
2014-2015	0.0295	0.0294	0.0320
	(0.0074)***	(0.0093)***	(0.0097)***
2013-2014 x Ln(Distance)	-0.0004	-0.0004	-0.0001
	(0.0006)	(0.0004)	(0.0005)
2014-2015 x Ln(Distance)	-0.0027	-0.0027	-0.0030
	(0.0009)***	(0.0011)**	(0.0012)**
Indigenous	-0.0072	-0.0074	-0.0105
	(0.0056)	(0.0050)	(0.0058)*
Indigenous x Ln(Distance)	0.0007	0.0008	0.0012
	(0.0006)	(0.0006)	(0.0007)*
2013-2014 x Indigenous	0.0072	0.0072	0.0082
	(0.0091)	(0.0077)	(0.0096)
2014-2015 x Indigenous	0.0029	0.0029	-0.0008
	(0.0085)	(0.0095)	(0.0103)
2013-2014 x Ln(Distance) x Indigenous	-0.0009	-0.0009	-0.0011
	(0.0010)	(0.0009)	(0.0011)
2014-2015 x Ln(Distance) x Indigenous	-0.0006	-0.0006	-0.0003
	(0.0010)	(0.0011)	(0.0012)
Age		0.0000	-0.0000
		(0.0000)	(0.0000)
Female		-0.0003	-0.0002
		(0.0001)**	(0.0001)*
Wealth Index		0.0001	0.0001
		(0.0001)	(0.0001)
Motor Disability		0.0004	0.0007
		(0.0032)	(0.0032)
Behind by 2+ years		0.0014	0.0014
		(0.0003)***	(0.0003)***
Diff. in School Quality			-0.0016
			(0.0005)***
Diff. in Ethnic Composition			-0.0101
			(0.0007)***
Diff. in Mean School Wealth			0.0011
			(0.0005)**
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.0223	0.0223	0.0207
	(0.0050)***	(0.0076)***	(0.0067)***
R^2	0.00	0.00	0.02
N	661,059	661,059	661,059

* p<0.1; ** p<0.05; *** p<0.01

Figure 29. Effects of mass transit on switching to schools in La Paz by ethnicity

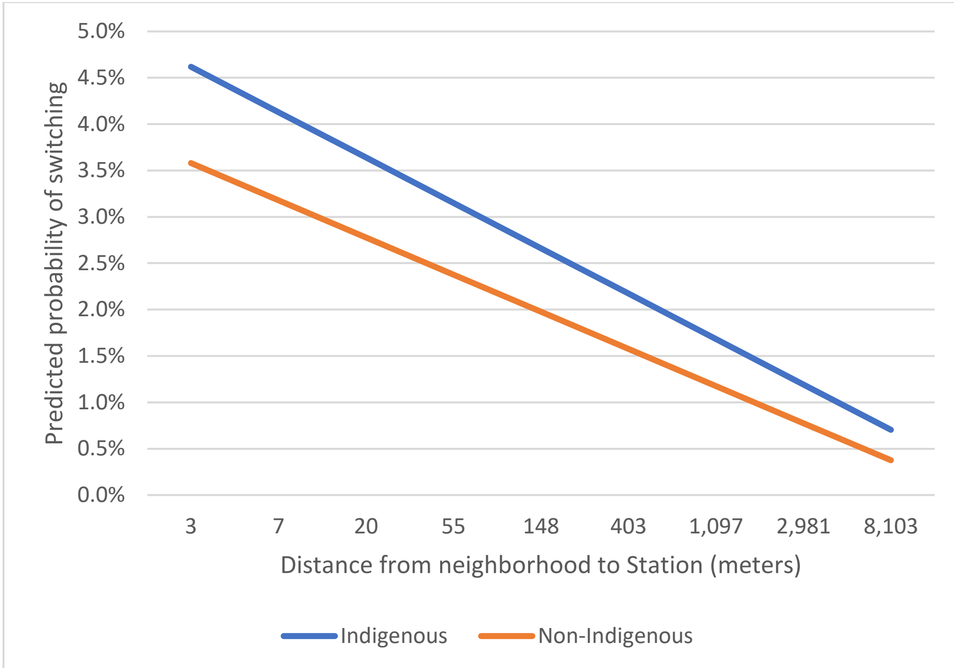


Table 23. *Effect of Mass Transit on Switching to Schools in La Paz by Wealth*

	Switch	Switch	Switch
Ln(Distance)	-0.0016	-0.0016	-0.0003
	(0.0005)***	(0.0005)***	(0.0006)
2013-2014	0.0157	0.0152	0.0152
	(0.0075)**	(0.0076)**	(0.0091)*
2014-2015	0.0489	0.0486	0.0485
	(0.0092)***	(0.0093)***	(0.0096)***
2013-2014 x Ln(Distance)	-0.0017	-0.0017	-0.0018
	(0.0008)**	(0.0008)**	(0.0010)*
2014-2015 x Ln(Distance)	-0.0051	-0.0050	-0.0051
	(0.0010)***	(0.0010)***	(0.0011)***
2nd Wealth Tercile	-0.0037	-0.0042	0.0052
	(0.0047)	(0.0047)	(0.0067)
3rd Wealth Tercile	0.0085	0.0077	0.0145
	(0.0055)	(0.0055)	(0.0061)**
2nd Wealth Tercile x Ln(Distance)	0.0004	0.0005	-0.0006
	(0.0005)	(0.0005)	(0.0008)
3rd Wealth Tercile x Ln(Distance)	-0.0009	-0.0009	-0.0017
	(0.0006)	(0.0006)	(0.0007)**
2013-2014 x 2nd Wealth Tercile	-0.0074	-0.0070	-0.0123
	(0.0063)	(0.0063)	(0.0085)
2013-2014 x 3rd Wealth Tercile	-0.0083	-0.0079	-0.0081
	(0.0070)	(0.0070)	(0.0080)
2014-2015 x 2nd Wealth Tercile	-0.0160	-0.0159	-0.0176
	(0.0090)*	(0.0091)*	(0.0098)*
2014-2015 x 3rd Wealth Tercile	-0.0242	-0.0240	-0.0242
	(0.0109)**	(0.0110)**	(0.0112)**
2013-2014 x 2nd Wealth Tercile x Ln(Distance)	0.0008	0.0008	0.0014
	(0.0007)	(0.0007)	(0.0010)
2013-2014 x 3rd Wealth Tercile x Ln(Distance)	0.0009	0.0009	0.0010
	(0.0008)	(0.0008)	(0.0009)
2014-2015 x 2nd Wealth Tercile x Ln(Distance)	0.0018	0.0018	0.0020
	(0.0010)*	(0.0010)*	(0.0011)*
2014-2015 x 3rd Wealth Tercile x Ln(Distance)	0.0027	0.0027	0.0028
	(0.0013)**	(0.0013)**	(0.0013)**
Age		-0.0000	-0.0001
		(0.0000)	(0.0001)
Female		-0.0003	-0.0002
		(0.0002)*	(0.0002)
Indigenous		-0.0019	-0.0022
		(0.0005)***	(0.0006)***
Motor Disability		0.0005	0.0007
		(0.0026)	(0.0026)
Behind by 2+ years		0.0014	0.0015
		(0.0004)***	(0.0004)***
Diff. in School Quality			-0.0016
			(0.0005)***
Diff. in Ethnic Composition			-0.0101
			(0.0007)***
Diff. in Mean School Wealth			0.0011
			(0.0006)*
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.0155	0.0167	0.0086
	(0.0044)***	(0.0045)***	(0.0054)
R^2	0.00	0.00	0.02
N	661,059	661,059	661,059

* p<0.1; ** p<0.05; *** p<0.01

Figure 30. Effect of mass transit on switching to schools in La Paz by wealth tercile

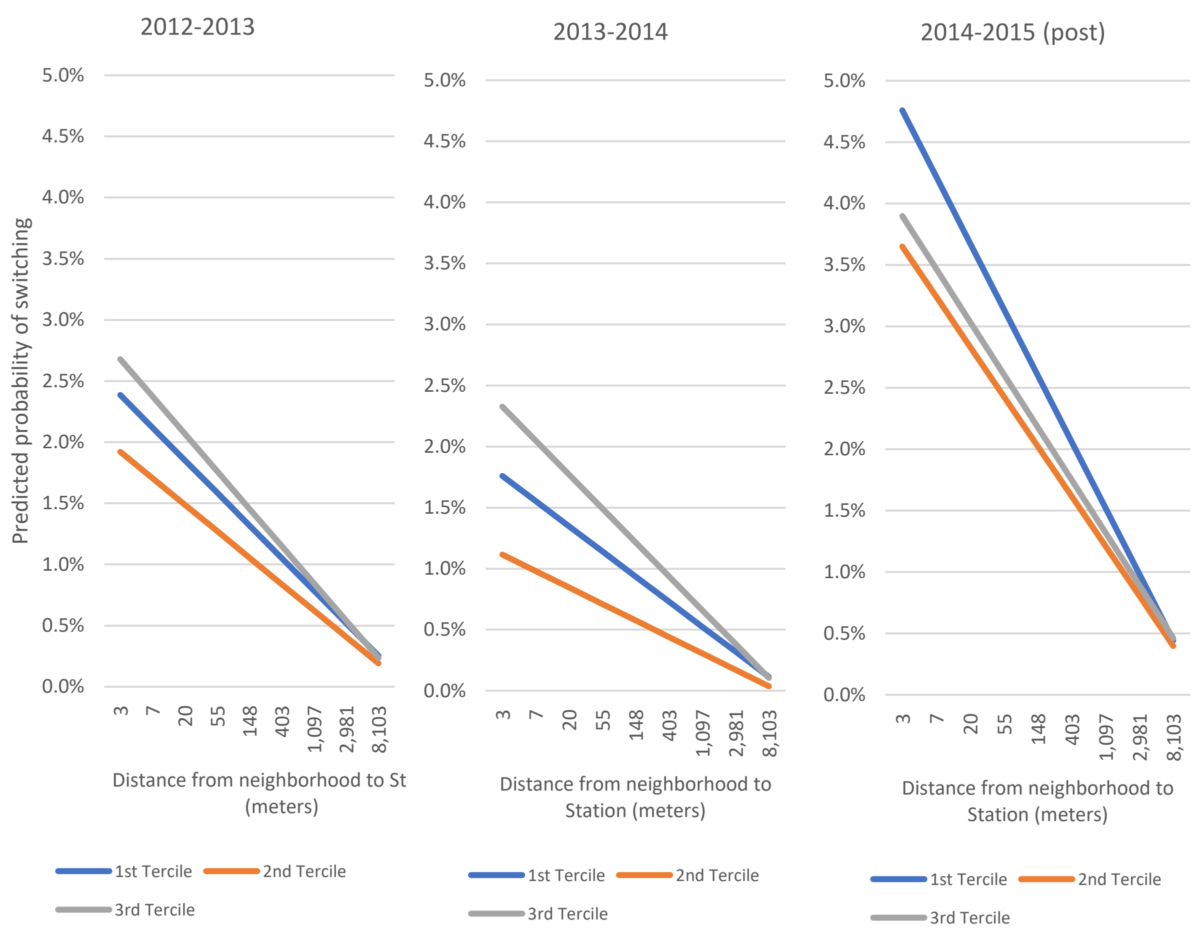


Table 24. *Effect of Mass Transit on Moving*

	Moved	Moved	Moved
Ln(Distance)	-0.0087	-0.0096	-0.0084
	(0.0041)**	(0.0041)**	(0.0041)**
2013-2014	-0.0421	-0.0427	-0.0327
	(0.0284)	(0.0284)	(0.0297)
2014-2015	-0.0866	-0.0860	-0.0855
	(0.0355)**	(0.0354)**	(0.0360)**
2013-2014 x ln(distance)	0.0032	0.0032	0.0021
	(0.0034)	(0.0034)	(0.0036)
2014-2015 x ln(distance)	0.0049	0.0049	0.0048
	(0.0032)*	(0.0032)*	(0.0032)*
Age		-0.0010	-0.0014
		(0.0003)***	(0.0003)***
Female		-0.0014	-0.0013
		(0.0007)*	(0.0007)*
Indigenous		0.0007	0.0011
		(0.0031)	(0.0030)
Wealth Index		-0.0017	-0.0022
		(0.0012)	(0.0011)*
Motor Disability		-0.0286	-0.0292
		(0.0106)***	(0.0103)***
Behind by 2+ years		0.0216	0.0224
		(0.0022)***	(0.0022)***
Diff. in School Quality			-0.0217
			(0.0027)***
Diff. in Ethnic Composition			-0.0026
			(0.0034)
Diff. in Mean School Wealth			-0.0003
			(0.0030)
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.1635	0.1847	0.1777
	(0.0347)***	(0.0358)***	(0.0355)***
R^2	0.00	0.00	0.01
N	661,059	661,059	661,059

* p<0.1; ** p<0.05; *** p<0.01

Table 25. *Effect of Mass Transit on Switching to Schools in La Paz Without Movers*

	All	Public	Private	Mixed
Ln(Distance)	-0.0008	-0.0001	-0.0005	-0.0002
	(0.0004)*	(0.0002)	(0.0002)**	(0.0001)
2013-2014	0.0019	0.0040	-0.0010	-0.0010
	(0.0045)	(0.0030)	(0.0025)	(0.0014)
2014-2015	0.0350	0.0236	0.0103	0.0012
	(0.0055)***	(0.0041)***	(0.0031)***	(0.0014)
2013-2014 x ln(distance)	-0.0003	-0.0005	0.0001	0.0001
	(0.0005)	(0.0004)	(0.0003)	(0.0002)
2014-2015 x ln(distance)	-0.0036	-0.0024	-0.0011	-0.0001
	(0.0006)***	(0.0005)***	(0.0004)***	(0.0002)
Age	-0.0001	-0.0001	-0.0000	-0.0000
	(0.0000)*	(0.0000)***	(0.0000)	(0.0000)
Female	-0.0001	-0.0003	0.0002	-0.0000
	(0.0002)	(0.0001)**	(0.0001)*	(0.0000)
Indigenous	-0.0018	-0.0004	-0.0014	-0.0001
	(0.0006)***	(0.0003)	(0.0004)***	(0.0001)
Wealth Index	0.0002	-0.0000	0.0002	0.0000
	(0.0001)	(0.0001)	(0.0001)**	(0.0000)
Motor Disability	-0.0002	-0.0009	0.0010	-0.0003
	(0.0023)	(0.0016)	(0.0016)	(0.0000)***
Behind by 2+ years	0.0012	0.0019	-0.0006	-0.0000
	(0.0004)***	(0.0003)***	(0.0001)***	(0.0001)
Diff. in School Quality	-0.0016	-0.0021	0.0003	0.0002
	(0.0005)***	(0.0004)***	(0.0002)	(0.0001)***
Diff. in Ethnic Composition	-0.0103	-0.0061	-0.0033	-0.0008
	(0.0008)***	(0.0005)***	(0.0006)***	(0.0001)***
Diff. in Mean School Wealth	0.0013	0.0000	0.0009	0.0003
	(0.0006)**	(0.0004)	(0.0004)**	(0.0001)***
Diff. in Student Pop. Size	-0.0000	-0.0000	0.0000	-0.0000
	(0.0000)	(0.0000)***	(0.0000)***	(0.0000)***
Constant	0.0116	0.0035	0.0059	0.0022
	(0.0037)***	(0.0020)*	(0.0021)***	(0.0012)*
R^2	0.02	0.02	0.01	0.00
N	607,382	607,382	607,382	607,382

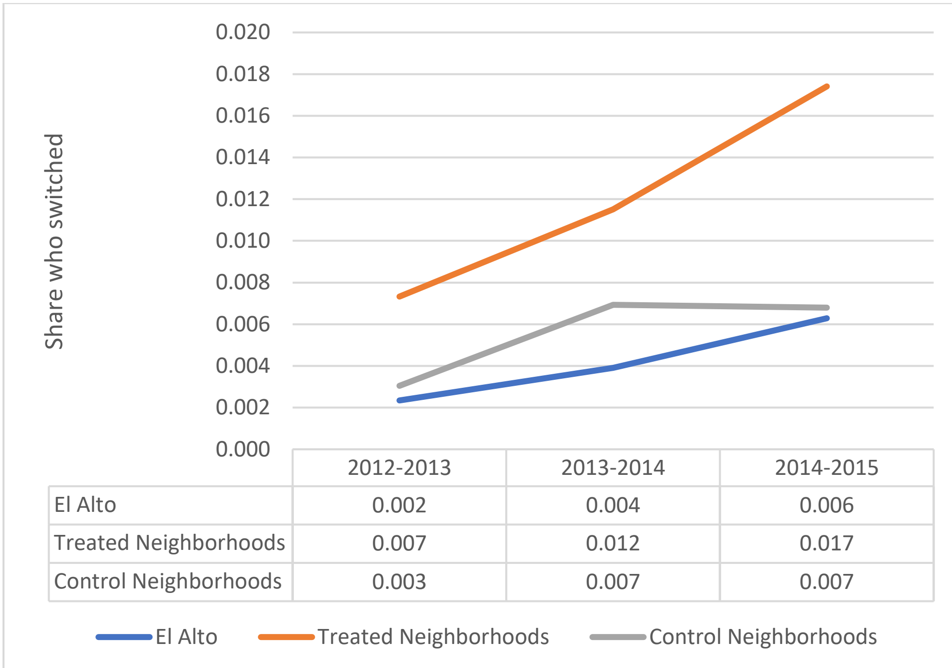
* *p*<0.1; ** *p*<0.05; *** *p*<0.01

Table 26. *Summary Statistics of Students Enrolled in Schools of El Alto* (N = 93,701)

Variable	Mean	Std. Dev.	Min	Max
Student lives in treated neighborhood	0.71	0.46	0	1
Public School at Time 2	0.63	0.48	0	1
Private School at Time 2	0.20	0.40	0	1
Mixed School at Time 2	0.16	0.37	0	1
Switched to School in La Paz	0.02	0.13	0	1
Switched to Public School in La Paz	0.0064	0.08	0	1
Switched to Private School in La Paz	0.0042	0.06	0	1
Switched to Mixed School in La Paz	0.0009	0.03	0	1
Distance (neighborhood to station in meters)	1337	576	137	2520
Ln(Distance)	7.08	0.51	4.92	7.83
Transition 1 (2012-2013)	0.32	0.47	0	1
Transition 2 (2013-2014)	0.34	0.47	0	1
Transition 3 (2014-2015)	0.34	0.47	0	1
Indigenous	0.69	0.46	0	1
Age	10.47	3.73	3	22
Female	0.49	0.50	0	1
Motor Disability	0.00	0.03	0	1
Behind by 2 years or more	0.05	0.22	0	1
Diff. in School Quality Index	-0.14	0.78	-4	4
Diff. in School Ethnic Composition	0.05	0.78	-4	4
Diff. in School Wealth Index	0.08	0.88	-4	4
Diff. in School Population Size	13.46	211	-1950	3538

Notes: Data from the Bolivian Ministry of Education's matriculation database RUDE (*Registro Único de Estudiantes*) for the years 2012-2015. The table only includes statistics for students who were enrolled in schools of El Alto in year 1 and then enrolled again in a school of metropolitan La Paz (La Paz, El Alto or other municipality) on the following year. This dataset limits the sample to students who lived in a set of neighborhoods that share d a contiguous border with La Paz (*N*=93,701). The bottom four rows show school-level controls that capture the difference in school quality, ethnic composition, mean wealth, and student body size between students' old and new schools.

Figure 31. El Alto students who switched to schools in La Paz



	2012-2013	2013-2014	2014-2015
El Alto	0.002	0.004	0.006
Treated Neighborhoods	0.007	0.012	0.017
Control Neighborhoods	0.003	0.007	0.007

Notes: Being in a treated neighborhood means that the student lived within one of the sampled neighborhoods that share a contiguous border with the neighborhood where the cable car was located. The control neighborhoods share a contiguous border with La Paz but do not share a contiguous border with areas benefited by the cable car stations.

Table 27. *Effect of Mass Transit on Switching to Schools in La Paz* (N = 93,701)

	All Schools	Public	Private	Mixed
Near	0.0030	0.0002	0.0028	-0.0000
	(0.0015)**	(0.0012)	(0.0011)**	(0.0003)
2013-2014	0.0027	0.0024	0.0003	-0.0000
	(0.0021)	(0.0015)	(0.0011)	(0.0003)
2014-2015	0.0026	0.0020	0.0004	0.0002
	(0.0015)*	(0.0012)*	(0.0011)	(0.0004)
Near x 2013-2014	0.0002	0.0002	-0.0001	0.0000
	(0.0023)	(0.0017)	(0.0012)	(0.0005)
Near x 2014-2015	0.0080	0.0058	0.0015	0.0007
	(0.0019)***	(0.0015)***	(0.0012)	(0.0005)
Age	-0.0003	-0.0003	0.0001	-0.0001
	(0.0002)	(0.0001)**	(0.0001)	(0.0000)*
Female	-0.0004	-0.0009	0.0007	-0.0002
	(0.0007)	(0.0006)	(0.0004)*	(0.0002)
Indigenous	-0.0047	-0.0014	-0.0031	-0.0002
	(0.0017)***	(0.0012)	(0.0009)***	(0.0003)
Wealth Index	0.0006	-0.0000	0.0003	0.0003
	(0.0005)	(0.0003)	(0.0004)	(0.0001)**
Motor Disability	0.0101	0.0007	0.0101	-0.0007
	(0.0169)	(0.0124)	(0.0120)	(0.0002)***
Behind by 2+ years	0.0073	0.0098	-0.0018	-0.0006
	(0.0022)***	(0.0021)***	(0.0007)**	(0.0002)***
Diff. in School Quality	-0.0055	-0.0046	-0.0021	0.0012
	(0.0019)***	(0.0012)***	(0.0012)*	(0.0005)***
Diff. in Ethnic Composition	-0.0152	-0.0058	-0.0085	-0.0009
	(0.0022)***	(0.0015)***	(0.0020)***	(0.0004)**
Diff. in Mean School Wealth	-0.0005	-0.0019	0.0007	0.0007
	(0.0022)	(0.0011)*	(0.0016)	(0.0003)**
Diff. in Student Pop. Size	-0.0000	-0.0000	0.0000	-0.0000
	(0.0000)	(0.0000)***	(0.0000)***	(0.0000)**
Constant	0.0101	0.0078	0.0012	0.0011
	(0.0032)***	(0.0019)***	(0.0019)	(0.0005)**
R^2	0.02	0.02	0.03	0.00
N	93,701	93,701	93,701	93,701

Notes: This table reports the effects of transit availability on the probability that El Alto residents, who are enrolled in schools of El Alto, switch to different types of school in La Paz. Column (1) shows the results for any school in La Paz; columns (2), (3), and (4) show the results for public, private and mixed schools, respectively. Being in a treated neighborhood means that the student lived within one of the sampled neighborhoods that share a contiguous border with the neighborhood where the cable car was located. The control neighborhoods share a border with La Paz, but do not share a border with the neighborhood where the cable car stations are available. Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Table 28. Effect of Mass Transit on Switching to Schools in La Paz by Wealth (N = 93,701)

	Switch	Switch	Switch
Near	0.0043	0.0038	0.0031
	(0.0011)***	(0.0010)***	(0.0015)**
2013-2014	0.0039	0.0038	0.0026
	(0.0013)***	(0.0014)***	(0.0022)
2014-2015	0.0034	0.0034	0.0022
	(0.0012)***	(0.0012)***	(0.0016)
Student at Lowest Wealth Quintile	-0.0003	-0.0003	-0.0023
	(0.0018)	(0.0018)	(0.0023)
Near x 2013-2014	-0.0001	-0.0002	-0.0001
	(0.0015)	(0.0016)	(0.0024)
Near x 2014-2015	0.0049	0.0048	0.0066
	(0.0017)***	(0.0017)***	(0.0020)***
2013-2014 x Lowest Wealth Quintile	0.0001	-0.0002	0.0005
	(0.0028)	(0.0029)	(0.0036)
2014-2015 x Lowest Wealth Quintile	0.0018	0.0013	0.0032
	(0.0031)	(0.0031)	(0.0038)
Near x 2013-2014 x Lowest Wealth Quintile	0.0021	0.0027	0.0011
	(0.0029)	(0.0030)	(0.0033)
Near x 2014-2015 x Lowest Wealth Quintile	0.0075	0.0080	0.0073
	(0.0040)*	(0.0040)**	(0.0044)*
Age		-0.0004	-0.0002
		(0.0001)***	(0.0002)
Female		-0.0004	-0.0004
		(0.0006)	(0.0007)
Indigenous		-0.0026	-0.0050
		(0.0014)*	(0.0017)***
Motor Disability		0.0069	0.0103
		(0.0134)	(0.0170)
Behind by 2+ years		0.0043	0.0071
		(0.0016)***	(0.0022)***
Diff. in School Quality			-0.0055
			(0.0019)***
Diff. in Ethnic Composition			-0.0151
			(0.0022)***
Diff. in Mean School Wealth			-0.0006
			(0.0022)
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.0031	0.0099	0.0115
	(0.0007)***	(0.0021)***	(0.0030)***
R^2	0.00	0.00	0.02
N	104,902	104,902	93,701

Notes: This table reports the effects of transit availability on the probability that El Alto residents, who are enrolled in schools of El Alto, switch to a school in La Paz. Being in a treated neighborhood means that the student lived within one of the sampled neighborhoods that share a contiguous border with the neighborhood where the cable car was located. The control neighborhoods share a border with La Paz, but do not share a border with the neighborhood where the cable car stations are available. Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Table 29. Effect of Mass Transit on Switching to Schools in La Paz by Ethnicity (N = 93,701)

	EA-LP Switch	EA-LP Switch	EA-LP Switch
Near	0.0039	0.0039	0.0032
	(0.0010)***	(0.0010)***	(0.0015)**
2013-2014	0.0028	0.0027	0.0052
	(0.0032)	(0.0031)	(0.0045)
2014-2015	0.0000	-0.0000	0.0001
	(0.0024)	(0.0024)	(0.0032)
Indigenous	-0.0021	-0.0020	-0.0035
	(0.0014)	(0.0014)	(0.0022)
Near x 2013-2014	0.0022	0.0022	-0.0011
	(0.0031)	(0.0031)	(0.0044)
Near x 2014-2015	0.0109	0.0108	0.0121
	(0.0031)***	(0.0031)***	(0.0034)***
2013-2014 x Indigenous	0.0014	0.0013	-0.0030
	(0.0031)	(0.0030)	(0.0047)
2014-2015 x Indigenous	0.0044	0.0043	0.0030
	(0.0024)*	(0.0025)*	(0.0032)
Near x 2013-2014 x Indigenous	-0.0027	-0.0025	0.0012
	(0.0030)	(0.0029)	(0.0043)
Near x 2014-2015 x Indigenous	-0.0058	-0.0056	-0.0054
	(0.0034)*	(0.0034)	(0.0039)
Age		-0.0005	-0.0003
		(0.0001)***	(0.0002)
Female		-0.0005	-0.0004
		(0.0006)	(0.0007)
Wealth Index		0.0002	0.0006
		(0.0005)	(0.0005)
Motor Disability		0.0068	0.0102
		(0.0133)	(0.0169)
Behind by 2+ years		0.0045	0.0073
		(0.0016)***	(0.0022)***
Diff. in School Quality			-0.0055
			(0.0019)***
Diff. in Ethnic Composition			-0.0152
			(0.0022)***
Diff. in Mean School Wealth			-0.0005
			(0.0022)
Diff. in Student Pop. Size			-0.0000
			(0.0000)
Constant	0.0048	0.0093	0.0091
	(0.0014)***	(0.0025)***	(0.0033)***
R^2	0.00	0.00	0.02
N	93,701	93,701	93,701

Notes: This table reports the effects of transit availability on the probability that Indigenous El Alto residents, who are enrolled in schools of El Alto, switch to a school in La Paz. Being in a treated neighborhood means that the student lived within one of the sampled neighborhoods that share a contiguous border with the neighborhood where the cable car was located. The control neighborhoods share a border with La Paz, but do not share a border with the neighborhood where the cable car stations are available. Clustered standard errors at the school level are shown in parentheses. * $p<0.1$; ** $p<0.05$; *** $p<0.01$

Figure 32. Share of students enrolled in schools of La Paz who are residents of El Alto

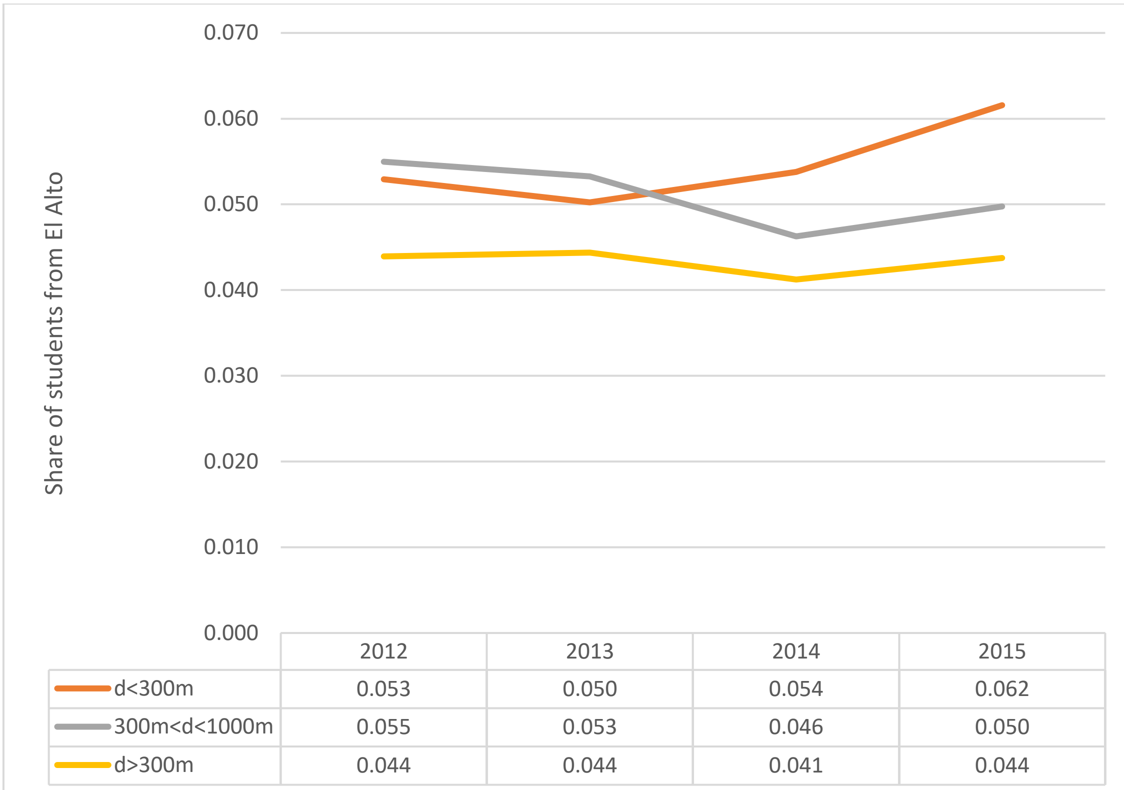


Figure 33. Share of students in public schools of La Paz who are El Alto residents

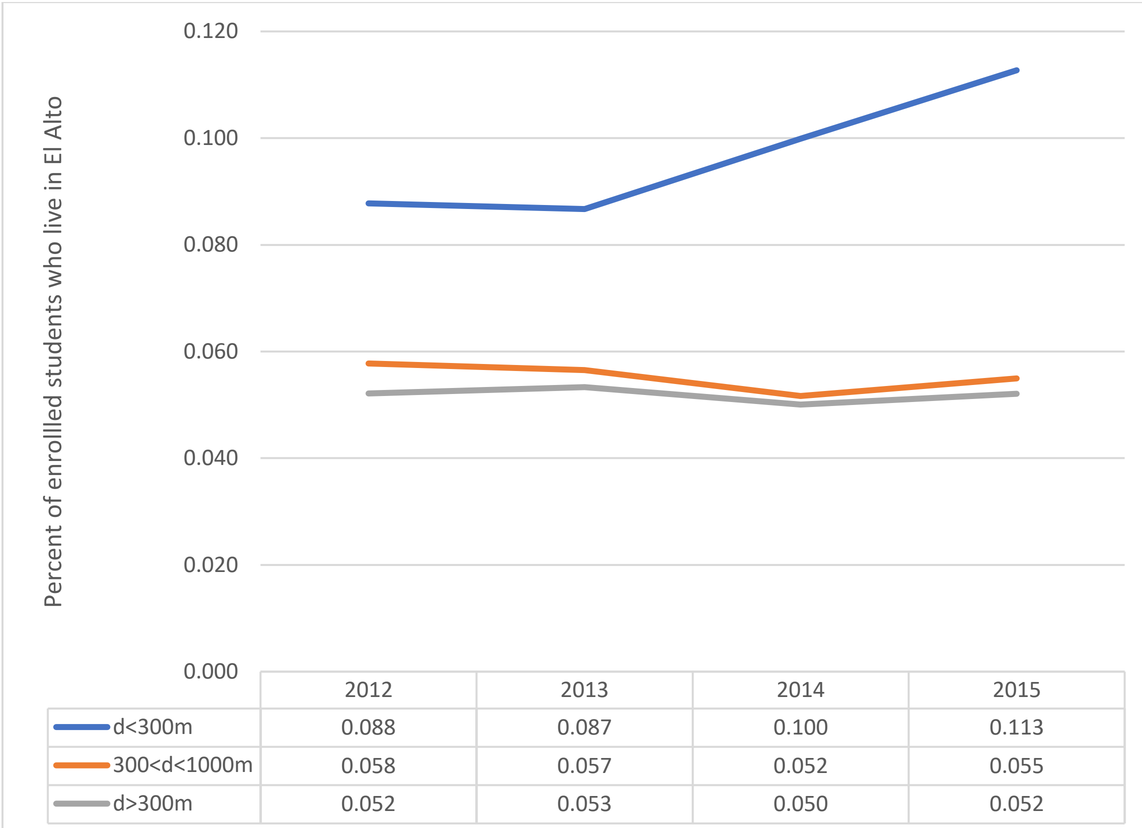


Table 30. *Effect of Mass Transit on School Composition*

	(1)	(2)	(3)	(4)
Post	0.0006	0.0048	0.0008	0.0054
	(0.0012)	(0.0013)***	(0.0012)	(0.0013)***
<300m. of Station	0.0092	0.0091	0.0117	0.0107
	(0.0166)	(0.0132)	(0.0132)	(0.0118)
<300m. of Station x Post	0.0086	0.0095	-0.0250	-0.0240
	(0.0050)*	(0.0056)*	(0.0125)**	(0.0110)**
Indigenous		0.0159		0.0121
		(0.0048)***		(0.0044)***
Female		0.0008		0.0008
		(0.0012)		(0.0011)
Wealth Index		-0.0032		-0.0010
		(0.0010)***		(0.0009)
Age		0.0020		0.0017
		(0.0005)***		(0.0005)***
Worker		-0.0010		-0.0021
		(0.0030)		(0.0030)
Public School			0.0212	0.0182
			(0.0059)***	(0.0059)***
<300m. of Station x Post x Public			0.0729	0.0686
			(0.0157)***	(0.0162)***
Constant	0.0431	0.0222	0.0311	0.0112
	(0.0033)***	(0.0057)***	(0.0038)***	(0.0069)
R^2	0.00	0.00	0.00	0.01
N	771,654	738,634	771,654	738,634

The table reports the effects of transit availability on the probability that students who are enrolled in schools of La Paz will come from El Alto. Clustered standard errors at the school level in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Table 31. *Effect of Cable Car Availability on Change in Distance to School*

	Change in Distance	Change in Distance	Change in Distance
Ln(Distance)	-0.0089	-0.0118	-0.0093
	(0.0055)	(0.0056)**	(0.0055)*
2013-2014	0.0187	0.0191	0.0263
	(0.0352)	(0.0350)	(0.0375)
2014-2015	0.0734	0.0768	0.0932
	(0.0379)*	(0.0376)**	(0.0392)**
2013-2014 x ln(distance)	-0.0026	-0.0027	-0.0036
	(0.0041)	(0.0040)	(0.0043)
2014-2015 x ln(distance)	-0.0077	-0.0080	-0.0099
	(0.0044)*	(0.0044)*	(0.0046)**
Age		-0.0020	-0.0025
		(0.0006)***	(0.0006)***
Female		-0.0015	-0.0011
		(0.0013)	(0.0012)
Indigenous		0.0123	0.0099
		(0.0051)**	(0.0051)*
Wealth Index		-0.0041	-0.0060
		(0.0015)***	(0.0014)***
Motor Disability		0.0173	0.0152
		(0.0222)	(0.0220)
Behind by 2+ years		0.0258	0.0259
		(0.0037)***	(0.0038)***
Diff. in School Quality			-0.0215
			(0.0062)***
Diff. in Ethnic Composition			-0.0310
			(0.0093)***
Diff. in Mean School Wealth			-0.0149
			(0.0088)*
Diff. in Student Pop. Size			-0.0001
			(0.0001)**
Constant	0.1354	0.1794	0.1744
	(0.0477)***	(0.0499)***	(0.0496)***
R2	0.00	0.00	0.01
N	650,676	650,676	650,676

Notes: The table reports a linear-probability model estimate of the effects of mass transit availability on the distance from home to school for El Alto residents. The treatment "2014-2015 x ln(distance)" captures the natural log of the distance from the students' neighborhood of residence to the closest cable car station at the time that the cable car service was available. Clustered standard errors at the school level are shown in parentheses. * p<0.1; ** p<0.05; *** p<0.01

Figure 34. Share of students from El Alto at Gregorio Reynolds School

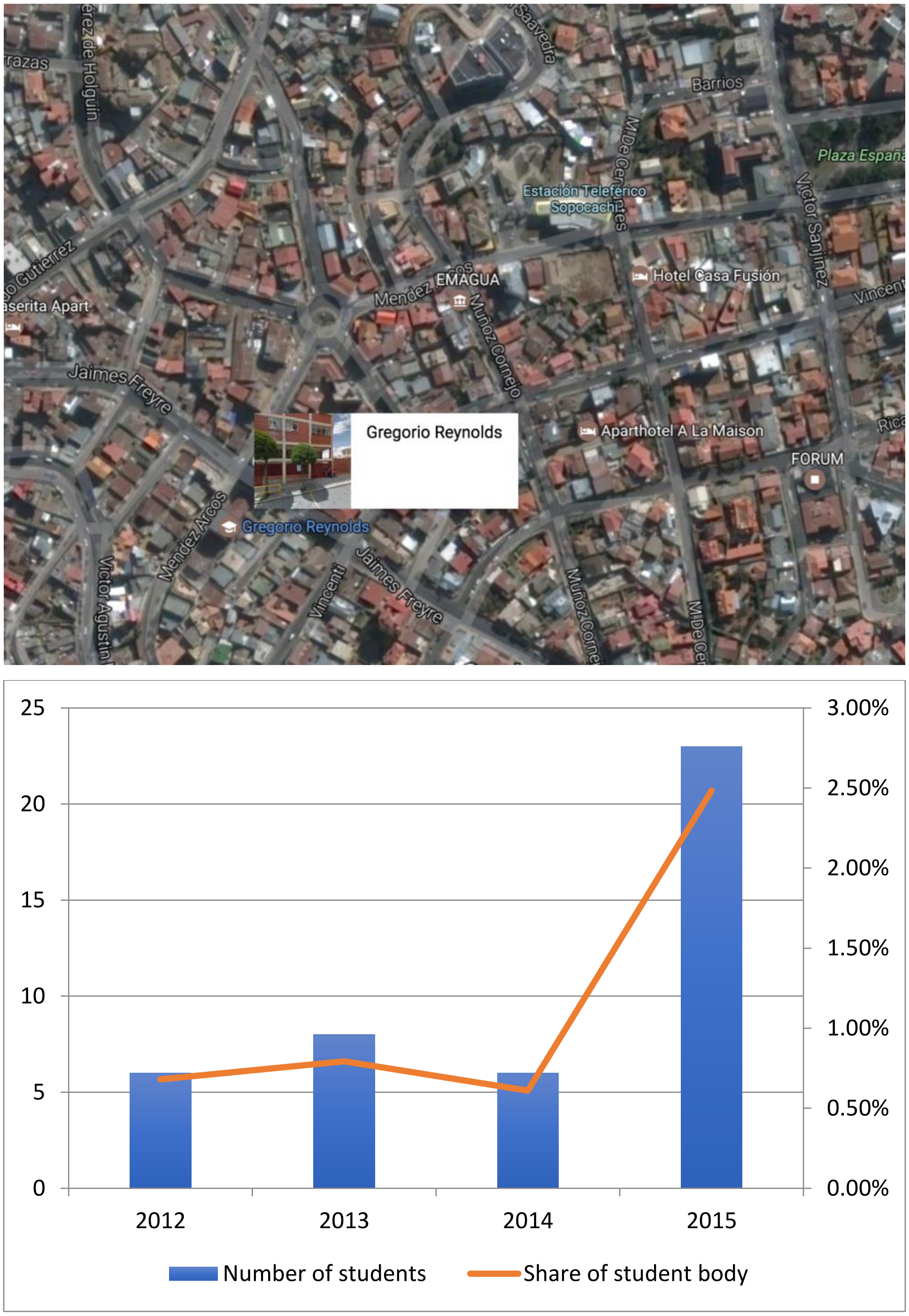
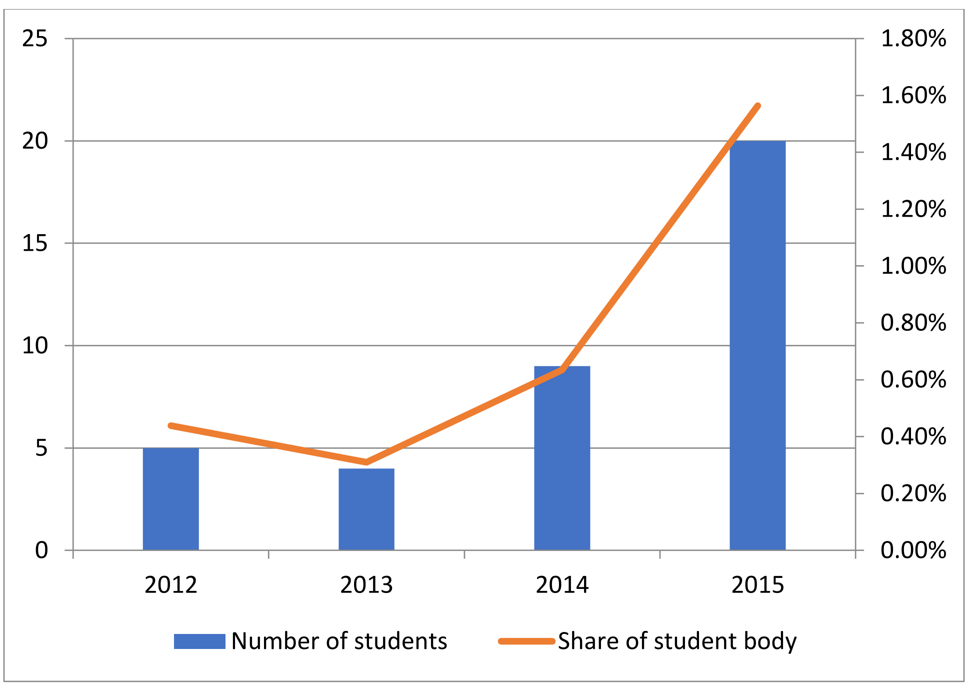


Figure 35. Share of students from El Alto at Unidad Educativa del Ejercito



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