# Stratification in Educational Decision Making: How Policy Interventions and Student Contexts Shape Inequality

by

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# TABLE OF CONTENTS

# LIST OF FIGURES

FIGURE

# LIST OF TABLES

TABLE

# LIST OF APPENDICES

# ABSTRACT

The decisions that students make about their educational attainment have profound impacts on their future economic, demographic, and social outcomes. These decisions, however, do not happen in a vacuum. There is a long tradition of research in sociology, education, and behavioral economics that has studied inequality in educational decision making and the various factors that contribute to creating, or reducing, this inequality. Despite extensive research, inequality in educational attainment persists. This dissertation takes a multimethod approach to identifying sources of inequality and evaluating policies aimed at reducing it. In three distinct empirical chapters, this dissertation extends the literature on educational decision making, expanding our knowledge of how inequality is created and maintained.

The first empirical paper, evaluates two "free tuition" policy designs, informing policy conversations about how to reduce economic inequality in selective college attendance. Proposed "free college" policies vary widely in design. The simplest set tuition to zero for everyone. More targeted approaches limit free tuition to those who demonstrate need through an application process. We experimentally test the effects of these two models on the schooling decisions of low-income students. An unconditional free tuition offer from a large public university substantially increases application and enrollment rates. A free tuition offer contingent on proof of need has a much smaller effect on application and none on enrollment. These results are consistent with students placing a high value on financial certainty when making schooling decisions.

The second paper focuses on the role of social context in shaping student decision making. There is a long history of sociological research that identifies the essential role of social forces in shaping educational attainment; however, siblings have been understudied as a direct mechanism contributing to educational decision making, overshadowed by the focus on parents and institu-

tions. Using longitudinal qualitative interviews with 36 high-achieving high school seniors from families with low incomes, I explore the unique role that older siblings play in shaping the post-secondary decision making of their younger siblings. I find that the support provided by siblings is distinct from other social resources. The intensity of the relationship, and the internal and external relevance, or the fact the information shared is recent and personalized to the students' circumstances, each make this relationship unique. By studying only parents or considering only the role of parent educational or economic circumstances in contributing to inequality, we ignore an important source of heterogeneity in the lives of students from families with low incomes.

The final empirical chapter describes gaps in postsecondary educational attainment between urban, rural, and suburban communities using student-level longitudinal data from the full population of Michigan public high school students. Using several recent high school cohorts, I document rates of college attendance, college selectivity, and bachelor's degree completion overall and within subgroups, providing updated estimates for urbanicity gaps in college attainment. Thirty-six percent of students from suburban high schools enroll in four-year institutions compared with 33 percent and 28 percent of students in rural and city high schools, respectively. Bachelor's degree attainment gaps are similarly large. There is less racial and economic inequality in college outcomes within rural areas than there is in cities; however, it does not come from improved outcomes among racially minoritized students or those from families with low incomes. Students in rural areas from more traditionally advantaged groups have substantially lower rates of college attainment than their suburban and city peers. Therefore, while media narratives about White, rural students falling behind are not inaccurate, they do not tell a complete story. This chapter highlights some key areas for policy intervention to better target the distinct needs of students.

# CHAPTER 1

# Introduction

The decisions that students make about their educational attainment have profound impacts on their future economic, demographic, and social outcomes. There is a long tradition of research in sociology, education, and behavioral economics that studies and evaluates educational decision making. Among other things, this body of research has made one fact abundantly clear: postsecondary educational choices do not happen in a vacuum. Where students live, their social networks and resources, their schools, and the policies and institutions that they encounter all shape these choices and contribute to inequality in educational attainment.

The benefits of a college degree for intergenerational mobility (Chetty et al., 2017; Torche, 2011), adult earnings (Chetty et al., 2017; Zimmerman, 2014), job quality and stability (Hout, 2012), demographic transitions (Hout, 2012), and civic engagement (Ahearn et al., 2022) have been well documented. Further evidence suggests that where students attend has implications for their outcomes, including long run earnings (Chetty et al., 2017). As a result, some national, state, and local policymakers have sought to address the persistent correlation between student background–income, race, parental education, and institutional context–and their postsecondary education outcomes–enrollment, enrollment selectivity, and collegecompletion. These policy interventions aim to address the barriers many students face in the transition to college. This dissertation will highlight that many policies aimed at increasing educational attainment still fall short of addressing the address key barriers and considerations faced by the students least likely to attend postsecondary education (Bailey and Dynarski, 2011; Chetty et al., 2017), but most likely

to benefit (Brand and Xie, 2010; Chetty et al., 2017; Zimmerman, 2014). This is due, in part, to unanswered questions about inequality in postsecondary educational access and completion.

This dissertation contributes to the literature on educational decision-making by evaluating three contexts that help shape student choices: policy environment, family circumstances, and geographic location. In three distinct empirical chapters, I investigate the design of public policies to effectively reduce inequality in postsecondary attainment; the role of family context in contributing to students' educational choices; and the role of geographic inequality in postsecondary attainment. The motivation for each of these empirical chapters is outlined in this chapter.

## 1.1 Dissertation Aims

College attendance and completion are deeply unequal: there are persistent, and in some cases, growing gaps by parental education, race, family income and wealth, and institutional resources (Lareau and Weininger, 2008; Pfeffer, 2008; Bailey and Dynarski, 2011; Chetty et al., 2017; Pfeffer, 2018; McDonough, 1997; Radford, 2013). While educational attainment gaps exist across many dimensions, particular attention has been paid to the strong and persistent correlation between family economic circumstances and student educational attainment. A series of policy interventions aimed to address the barriers that students from families with low incomes face in the transition to postsecondary education. One particularly successful financial aid policy at the University of Michigan (UM), the HAIL Scholarship Study, was designed to test whether a personalized offer of a four-year tuition guarantee could reduce economic inequality in selective college attendance. The intervention more than doubled application and enrollment to a highly selective institution for Michigan public high school students from families with low incomes (Dynarski et al., 2021).

This intervention showed that policy can effectively reduce inequality in selective college attainment, however, it left some questions unanswered. What components of this intervention are necessary for its success, and how can this policy be scaled? What drives heterogeneity in re-

sponse? Beyond economic inequality, what other sources of inequality may be driving the effects? How do other factors in students' lives, beyond financial costs, shape decision-making in ways that are not supported by this intervention? Answers to these questions will allow us to expand on the success of interventions like the HAIL Scholarship to more effectively reduce inequality in postsecondary enrollment and completion by building on the strategies that students already use to overcome barriers.

The first aim of this dissertation is to understand the elements of financial aid policies that are necessary to address the barriers to college enrollment that students from families with low incomes face. "Free tuition" policies differ in their eligibility and implementation details. The most straightforward "free tuition" design would set tuition to zero for all students. More complicated versions limit "free tuition" to those who apply for student aid and demonstrate financial need through a months-long paperwork process. Most institutional "free tuition" guarantees, like one at the University of Michigan, take the more complicated approach. This approach, however, often has the unintended effect of excluding some of the targeted beneficiaries (Finkelstein and Notowidigdo, 2019; Herd and Moynihan, 2019). If the HAIL Scholarship's success was due only to providing students with information about financial aid at the University of Michigan in a flashy envelope with official branding, it should not be necessary to provide students with the kind of guarantee that policy makers fear. Policy makers often worry that they will spend resources providing aid to individuals who do not, in their opinion, need the support. Hence the need verification process. However, if it is indeed the upfront guarantee of four-years of free tuition that drove HAIL's success, an informational campaign would not be successful.

In the first empirical chapter, my co-authors and I experimentally test the effects of two "free tuition" policy designs on highly selective college attendance among students who are academically prepared for admission to such an institution and from families with low incomes, testing a set of mechanisms thought to drive successful financial aid policies. The first replicates the original HAIL Scholarship design; high school seniors randomized to this treatment arm receive an early commitment of free tuition at the University of Michigan, provided they apply and are admitted.

Students randomized into the second treatment arm are informed of the existing "free tuition" program at the University of Michigan that requires annual need verification, and confirms eligibility only after students apply. The results of this evaluation speak to the value placed on policies that resolve uncertainty about the aid they will receive.

This randomized, controlled trial is also an opportunity to understand the social and structural processes through which decision-making occurs, and inequality is reproduced. What about the other processes that shape student decision making beyond uncertainty about college costs? There is a long history of sociological research that identifies the essential role of social forces in shaping the opportunities students have available to them and the choices they make (e.g. Coleman, 1988). Extensive research has documented the important role that families play in intergenerational educational inequalities. College-educated parents transmit their knowledge of how to navigate the transition to postsecondary education in both formal and informal ways throughout students' lives (Pfeffer, 2008; Lareau and Weininger, 2008). Parents with knowledge of the system, namely, those parents who have themselves completed a college education, are able to employ that knowledge to help their children navigate the necessary steps (Hamilton, 2016; Pfeffer, 2008).

Successful resource and support systems must be able to effectively deliver key information and support to students to help them evaluate the fit of a given course of action for their individual goals. However, with such attention paid to parents, other family resources have been understudied as direct contributors to educational decision making. In the second paper, I use longitudinal, qualitative interviews to understand mechanisms driving the influence of social capital, identifying the integral role that older siblings play in students' postsecondary decisions, distinct from the well documented role of parents and counselors. In asking what unique role siblings play in supporting their younger siblings through the postsecondary decision-making process (both in whether and where to pursue postsecondary education), this paper advances our understanding of both the way students make decisions, and the contributions of the social network to growing educational stratification. By focusing on siblings as a distinct resource, separate from family, school, or peer support, this paper contributes to our understanding of the ways in which social networks

contribute to social reproduction, educational inequality, and economic stratification. Further, it highlights that while experimental evaluations are effective at identifying whether an intervention is effective at reducing the source of inequality that it targets, they are insufficient (in isolation) for identifying the other social and institutional processes that shape the choices students make.

While economic inequality has long been a target of federal, state, and institutional policy interventions, geographic inequality in educational attainment has recently gained media attention. Specifically, lagging bachelor's degree attainment among rural youth has drawn concern from the media and policy leaders. Despite higher high school graduation rates, rural high school graduates attend college at lower rates than their suburban peers (U.S. Department of Education, National Center for Education Statistics, 2014) and are less likely to attend a college that matches their academic achievements than are their urban and suburban peers (Byun et al., 2012). Reducing inequality in college access and completion has long been cited as a goal of local, state, and federal policy intervention; however, the geographic differences in the barriers students face in their pursuits of postsecondary education are often overlooked. Most studies evaluating the role of school, community, and economic inequality on educational outcomes focus on urban areas where more students are concentrated; therefore, we know little about the specific barriers facing rural youth in their pursuit of postsecondary education and how these vary from those faced by students in urban and suburban places. Further, the greater effectiveness of policies like the HAIL Scholarship intervention in rural areas, relative to cities or suburbs (Dynarski et al., 2021), highlights the need for increased attention to geographic inequality.

While economic inequality is well documented, the unique barriers faced by students in rural areas is less understood. The third empirical chapter aims to fill this gap by providing estimates for rural-city-suburban inequality in postsecondary attainment using longitudinal administrative data and documenting heterogeneity in this relationship across a set of student characteristics. This paper uses more recent cohorts of students than existing research on rural-urban-suburban inequality (e.g. Byun et al., 2012), and focuses specifically on college enrollment and completion among Michigan public high school students. This chapter builds on a body of scholarship that

identifies several barriers that may be uniquely challenging for students in rural areas, including access to postsecondary institutions (Hillman, 2016; Klasik et al., 2018), community compositions, including local bachelor's degree completion rates (Byun et al., 2012; Smith et al., 2013); as well as factors that may drive differences between city and rural areas like school composition (e.g. Michelmore and Rich, 2022); and, student race and economic circumstances (e.g. Michelmore and Rich, 2022; Bennett and Xie, 2003).

The multi-method approach used across these empirical chapters answers three distinct questions that aim to address one central problem: inequality in the options students have for economic mobility through postsecondary education. Whether due to economic or policy uncertainty, social capital constraints, or differences in resources due to where they live, understanding the ways these intersecting contexts shape educational decision-making may inform policy design that helps students make decisions that best achieve their goals.

# CHAPTER 2

# The Power of Certainty: Experimental Evidence on the Effective Design of Free Tuition Programs[1]

A long line of research examines policies to increase college enrollment, especially among low-income students (see Dynarski and Scott-Clayton (2013) and Page and Scott-Clayton (2016) for reviews). Recently, the policy debate has focused on a variety of "free college" proposals. These policies differ in their eligibility and implementation details, with the most straightforward setting tuition to zero for all students. More complicated versions limit free tuition to those who apply for student aid and demonstrate financial need through a months-long paperwork process.

Complicated application processes have been shown to discourage takeup in means-tested programs, especially among those with the greatest need (Currie, 2006; Finkelstein and Notowidigdo, 2019; Herd and Moynihan, 2019). This includes financial aid for college (Dynarski and Scott-Clayton, 2006; Bettinger et al., 2012). Research suggests that seemingly minor, bureaucratic changes in the aid process will produce outsized effects on behavior. We explore this hypothesis in a large-scale field experiment.

We randomly assign high-achieving, low-income high school seniors to receive an early com-

[1]Chapter 2 is co-authored with Susan Dynarski, Katherine Michelmore, Stephanie Owen, and Shwetha Raghuraman. A version of this chapter appears as: Burland, Elizabeth, Susan Dynarski, Katherine Michelmore, Stephanie Owen, and Shwetha Raghuraman. forthcoming. "The Power of Certainty: Experimental Evidence on the Effective Design of Free Tuition Programs." American Economic Review: Insights. doi: 10.1257/aeri.20220094. This project was approved by the University of Michigan's Health Sciences and Behavioral Sciences Institutional Review Board (under study research ID HUM00096289). This study is registered at the randomized trial registry of the American Economic Association under RCT ID AEARCTR-0001831, with 10.1257/rct.1831-3.0. A pre-analysis plan was filed for this evaluation in August 2019 (Burland et al., 2023).

mitment of four years of free tuition at the University of Michigan (UM), a highly selective public university, provided they apply and are admitted.[2] All of these students are eligible for means-tested subsidized school meals, and therefore have family incomes near the poverty line.[3] At UM, the vast majority (90 percent) of such students receive grants that fully cover tuition (and typically receive thousands more to cover living expenses). A commitment of free tuition to this population of students is therefore relatively cheap for the university, while providing students certainty that their tuition is zero.

In an earlier experiment at UM (Dynarski et al., 2021) this early commitment more than doubled application and enrollment rates. For the present study we add a new treatment arm, in which we inform students of an existing "free tuition" program at UM that (like typical aid in the US) requires an annual application, does not provide a four-year guarantee, and confirms eligibility only *after* college admission. A control group receives business-as-usual recruitment materials and is eligible for the *same* financial aid as this new treatment arm.

Students in both treatment arms applied to UM at higher rates than the control group, indicating that sending out information about "free tuition" increases students' willingness to apply. But the increase in applications was three times larger among students given the up-front, four-year commitment: 63 percent of them applied to UM, an increase of 28 percentage points over the control group's 35 percent. In the informational arm 44 percent applied, the application rate increased by just 8 percentage points.

The up-front commitment of free tuition increased the share of students enrolling at UM to 26 percent (from 17 percent in the control group), an increase of roughly 50 percent. The new, informational arm had no detectable effect on enrollment. We conclude that "free college" policies that require verification of aid eligibility after application (the current status quo) have limited scope for affecting student enrollment.

[2]For brevity, we use "tuition" to refer to tuition and all required fees. At UM, this is a minor distinction, since fees are small (roughly $200, with in-state tuition $16,000). But fees can be greater than tuition. In Massachusetts, a "free tuition" program left students still paying thousands in fees (Cohodes and Goodman, 2014).

[3]They are identified, for the purposes of this study, using restricted-use, administrative data on eligibility for subsidized school meals.

## 2.1 The U.S. Financial Aid System

Higher education in the U.S. is characterized by a high degree of price discrimination, with some students paying the full "sticker price" and others a lower "net price" after grant aid is applied. As a rule, students do not know the net price they will face before they apply to colleges. Federal aid, such as the Pell Grant, is fairly predictable given a student's family income and household size (Dynarski and Scott-Clayton, 2006). But the Pell Grant isn't generous enough to cover tuition and fees at four-year colleges.[4] Getting tuition to zero at four-year colleges requires a combination of state grants, private scholarships, and price discounts from the colleges themselves (this last is referred to as "institutional aid").

Individual colleges "package" these various sources of aid to construct a net price for each student, communicated in an offer letter. To get offer letters, students must apply to colleges, fill out the Free Application for Federal Student Aid (FAFSA), and be admitted. Governments and institutions use the extensive financial data on the FAFSA to calculate an "Expected Family Contribution (EFC)," a measure of a student's ability to pay. For students entering college from high school, offer letters typically arrive in March or April of the senior year. But offer letters can arrive as late as the summer after high school for those whose aid applications are hung up by bureaucratic delays.

Since institutional aid varies considerably across schools (and within schools over time), it is not at all straightforward for students to predict their net price ahead of time. Schools have latitude in packaging aid. Some require students to complete additional aid applications beyond the FAFSA. The most common of these is the CSS Profile, administered by the College Board and required by many selective private colleges (and a handful of public schools, including UM). The Profile requires financial information beyond that gathered by the FAFSA, including home equity and income from non-custodial parents. Participating colleges use this additional data to customize their definition of need (EFC) when distributing institutional aid. An implication is that a student will face varying net prices even among colleges that commit to meeting students' full need.

[4] By contrast, the Pell Grant is generous enough to cover tuition costs at most community colleges.

Once a student enrolls in a given college for a given net price, their future costs remain unpredictable. As a rule, students get only a one-year commitment on their net price. Students have to reapply for aid annually. During the time a student is enrolled, tuition will likely rise and aid policies may shift at the federal, state, or institutional level. The bottom line is that, in the US system, students and families face uncertainty in net prices across colleges, across time, and within colleges over time.

## 2.2 Setting and Research Design

The complexity and unpredictability of the financial aid system has informed an ongoing initiative at the University of Michigan at Ann Arbor (UM) aimed at closing income gaps in college choices. Since 2016, UM has offered thousands of low-income students an up-front guarantee of four years of free tuition (the "HAIL Scholarship"). HAIL diverges from typical financial aid in promising free tuition *before* application, waiving financial aid forms, and committing to four years of aid.

A previous experimental evaluation revealed dramatic effects of HAIL on the behavior of low-income, high-achieving students. Students randomized to receive the HAIL offer were more than twice as likely as those in a "business as usual" control group to apply to, be admitted by, and enroll at the University of Michigan (Dynarski et al., 2021).[5]

The HAIL Scholarship was designed in a close, ongoing partnership between our research team and university administrators. We worked together to define the terms of HAIL and how it would be communicated to students. Our research team used data from the Michigan Department of Education (MDE) to identify the high-achieving, low-income students who got the HAIL offer. All of these students complete a needs test to receive subsidized school meals; UM could therefore commit up-front to covering their tuition without incurring much additional expense. In fact, as we show later, over four years at UM, the first two cohorts receiving HAIL received the same grant aid as control students.

[5]Further analysis showed no evidence that the HAIL intervention diverted students from other highly selective colleges.

Independent of our partnership, university administrators continued long-standing efforts to attract a diverse set of students, including school visits, on-campus programming, and marketing. In 2017, UM announced a new program, the Go Blue Guarantee, as part of these recruitment efforts. The Go Blue Guarantee promises free tuition to (in-state) students with income below $65,000 and assets below $50,000. Despite the "guarantee" in the title, receipt of the Go Blue Guarantee is conditional on verification of income and assets through the traditional aid system, described in the previous section. Students learn of their eligibility for the Go Blue Guarantee only after applying to UM, filling out aid forms, being admitted, and getting an offer letter that details their net price.

Some elements of HAIL, namely the promise of "free tuition," were built into the Go Blue Guarantee, while others, including the waiving of aid forms and the four-year commitment, were not. Unlike HAIL, which was limited to a set of students who had already qualified for need-based, subsidized school meals, the Go Blue Guarantee was widely advertised through billboards, TV commercials, and print media.

If the success of HAIL was largely due to eliminating informational barriers—informing low-income, high-achieving students that UM was affordable and a good academic fit—then the Go Blue Guarantee could potentially achieve the same goals through marketing, without an up-front commitment. We as researchers were not sanguine since previous work had shown that informational interventions about college costs did nothing to change student behavior (e.g., Bettinger et al., 2012; Bergman et al., 2019).

After the Go Blue Guarantee had been in place for a few years, we worked with the university to gauge its effectiveness with a three-armed randomized trial.[6] One treatment arm replicates the original HAIL offer: a mailing with an unconditional, up-front offer of four years of free tuition and encouragement to apply. A second treatment, which we refer to as the Go Blue Encouragement

[6]It would have been informative to include enough arms to separately identify the effects of each component of the treatments (information about aid, a guarantee of free tuition, praise of students' academic achievement). In practice, we were constrained by the capacity of the university to manage multiple treatment arms as well as by statistical power: about 2000 low-income seniors each year meet the academic criteria for inclusion in the study. Expanding this low-income sample would require adding students with a low probability of admission to UM, which our partners did not want to do.

(GBE), contains information about the Go Blue Guarantee and encourages students to apply. A control arm receives business-as-usual materials that describe UM and encourage students to apply.

Communications for the two treatment arms (HAIL and Go Blue Encouragement) were made as similar as possible. Both highlighted "free tuition" and praised students' academic achievements. The packets were the same size and were similarly designed with UM branding and bright coloring (Appendix A). Each packet included a letter signed by the president of the university. These letters were identical but for a single paragraph. In the HAIL arm this paragraph read:

> We believe you to be an academically excellent student who has worked hard for your achievements. If you apply to U-M and are admitted for the fall 2020 term, we will reward your hard work with the **HAIL Scholarship**, which covers the full cost of your in-state tuition for four years of study at our Ann Arbor campus. That's an approximate $66,000 value to you and your family. Additionally, after a review of your financial aid applications, you will likely be eligible for additional aid to cover costs of housing, meals, textbooks, and other expenses.

For students in the Go Blue Encouragement arm, this paragraph instead read:

> We believe you to be an academically excellent student who has worked hard for your achievements. That's why we hope you are planning to apply to the University of Michigan. Furthermore, our **Go Blue Guarantee** can help you with your college costs, as it covers the full cost of in-state tuition for in-state students who are admitted to the Ann Arbor campus and whose families earn incomes of $65,000 or less, with $50,000 or less in assets. If your family earns more, you can still Go Blue; we provide tuition support for families with incomes up to $180,000.

Letters to parents, mailed two weeks after the student packets, described the program (HAIL or Go Blue Guarantee) and encouraged them to help their children apply. Emails to school principals, sent around the same time as the student packets, explained the program, listed eligible students,

and asked the principal to transmit the information to school staff who supported students in their college applications.

Comparing the three experimental conditions sheds light on existing barriers within the aid system. In expectation, control and Go Blue Encouragement students face identical aid eligibility. Any differences in outcomes between the control and Go Blue Encouragement arms reflect informational barriers, since all of these students are eligible for the same aid.

The HAIL and Go Blue Encouragement arms both get information about aid and an encouragement to apply. The HAIL arm, unlike the Go Blue Encouragement arm, is guaranteed free tuition early (before application), without verification, and for four years. Comparing outcomes for HAIL and the Go Blue Encouragement arms therefore captures the effect of the only difference between their treatments: an up-front, unconditional, four-year tuition guarantee.

## 2.3 Data, Sample, and Randomization

We identify students for the intervention using longitudinal, student-level administrative data from MDE that contain the universe of students attending public high schools in Michigan (Michigan's Center for Educational Performance and Information, 2022a); (Michigan's Center for Educational Performance and Information, 2022b).

We identify high-achieving students using high school GPA and SAT scores, which come from mandatory, in-school 11th grade testing. GPA is self-reported on the SAT student questionnaire.[7] For this intervention, qualifying SAT scores start at 1100 and qualifying GPAs at a B. Students with higher test scores faced a lower GPA threshold and vice versa. The Office of Enrollment Management (OEM) at UM set the GPA and score cutoffs; they are similar to the criteria the school uses when gleaning prospective recruits from national data on SAT takers.[8]

[7]For high-achieving sample students in earlier cohorts, self-reported GPA on the SAT questionnaire was closely aligned to the official GPA on transcripts.The state of Michigan stopped collecting transcripts from school districts several years ago.

[8]Grades and scores alone do not determine admission. Like most highly selective colleges, UM uses a holistic admissions process that also considers factors such as family background and extracurricular activities.

We identify low-income students using data on qualification for federally subsidized school meals. Students with family income below 130 percent of the federal poverty line qualify for free meals and those with incomes up to 185 percent of the poverty line qualify for reduced-price meals. In 2020, the thresholds for a free or reduced-price meal were $34,060 and $48,470, respectively, for a family of four.

Of the approximately 100,000 juniors in Michigan's 1,000 public high schools in the 2018-19 school year, 1,796 students from 477 schools met both the income and academic criteria for the sample. Four-fifths of our sample[9] qualifies for a free lunch and the remainder for a reduced-price lunch. The mean SAT in our sample is 1260 and 85 percent of the sample has a GPA of A or A+.

### 2.3.1 Randomization

We randomly assign high schools to the treatment arms. That is, all seniors in a school who meet the income and academic criteria are assigned the same treatment status. We do this because we hypothesize treatment spillovers within schools, which would attenuate estimated effects toward zero if we randomized within schools. The probability of assignment to each arm is one-third.

We stratify the sample by region (Southeast vs. rest of Michigan) and urbanicity (city vs. suburb, town, or rural) and randomize within each of the resulting four strata. We chose these strata because in our earlier experiment students in rural areas responded more strongly to the treatment (Dynarski et al., 2021). We rerandomized to achieve balance within region on school characteristics (see Appendix Table A.1).

The randomization resulted in a HAIL arm of 595 students in 159 schools, a Go Blue Encouragement arm of 591 students in 159 schools, and a control arm of 610 students in 159 schools. Sample characteristics are shown in Table 2.1. A third of the schools are in the Southeast region of the state, which includes the metropolitan areas of Ann Arbor, Detroit, and Lansing. Another one-sixth of schools are in the largely rural Upper Peninsula. The remaining schools are scattered

[9]Unless otherwise noted, we report school-level means, which weight each school equally, to be consistent with our empirical specifications. Student-level means are very similar.

across the Lower Peninsula, with many in the Grand Rapids area. Over half the schools are rural, about a third are suburban, and the remainder urban.

Based on race categories that are not mutually exclusive, our sample is 82 percent White, 9 percent Black, 7 percent Hispanic, 8 percent Asian, 2 percent American Indian, and less than one percent Native Hawaiian or Pacific Islander. Seven percent of the sample belongs to more than one of these categories.

We create a summary measure of the likelihood of attending a highly selective college like UM. We use pretreatment characteristics to create a predicted probability for each student.[10] For our sample, the mean predicted probability of attending a school at least as competitive as UM is 13 percent.

Balance checks are shown in Appendix Table A.1. None of the pairwise comparisons between the treatment and control groups is statistically significant at conventional levels. This is substantiated by joint F-tests for each pair of treatment arms, which reveal that, together, these observed characteristics do not predict treatment status.

## 2.4 Empirical Strategy

We estimate the effect of the HAIL and Go Blue Encouragement treatments on application, admission, and enrollment at the University of Michigan, as described in our pre-analysis plan (Burland et al., 2023). We use internal data on these outcomes from the university (University of Michigan Office of Financial Aid, 2022; University of Michigan Office of Enrollment Management, 2022), as well as data from the National Student Clearinghouse (Michigan's Center for Educational Performance and Information, 2022a); (Michigan's Center for Educational Performance and Information, 2022b) that tracks college enrollment nationwide.

[10]To construct this index, we use historical cohorts of students to estimate a regression of highly selective college attendance on academic and demographic characteristics (test score, GPA, race, gender, an indicator for persistent economic disadvantage, urbanicity, region, and number of high-achieving, low-income students in the school). We then apply the estimated coefficients to our sample to assign them predicted probabilities.

We estimate the following by ordinary least squares (OLS):

$$Y_j = \beta_0 + \beta_1 HAIL_j + \beta_2 GB\,Encouragement_j + S_j + u_j \tag{2.1}$$

where $Y_j$ is an outcome of interest at school $j$. We collapse the individual student data to the school level and conduct analysis on these means. $HAIL_j$ and $GBEncouragement_j$ indicate assignment to the HAIL or Go Blue Encouragement treatment group, respectively. $S_j$ is a vector of strata dummies.

$\beta_1$ and $\beta_2$ are the parameters of interest and measure the causal effect of being randomized into the HAIL or Go Blue Encouragement treatment arm, respectively, relative to the control arm. This is the estimated effect of the intent to treat (ITT). These parameters represent the ITT with schools weighted equally.

## 2.5 Results

The estimated effects of the HAIL and Go Blue Encouragement treatments are in Panel A of Table 2.2. Appendix Figure A.1 depicts the effects visually. Relative to the control condition, the HAIL offer increased the UM application rate by 28 percentage points, while the Go Blue Encouragement treatment increased it by 8 percentage points. HAIL increased admission to UM (unconditional on application) by 9.6 percentage points, while GBE increased admission by a statistically insignificant 2.5 percentage points. Enrollment effects for the two treatments are also very different. The HAIL offer increased enrollment by nearly 9 percentage points, while the Go Blue Encouragement had no detectable effect.

The acceptance rates for induced applicants (obtained by dividing treatment effects on admission by treatment effects on application; Panel C of Table 2.2) from the two treatment arms are both about 30 percent. This suggests that applications induced by the two treatments were viewed as similarly qualified by admissions officers (we do not have admissions scores or notes). These acceptance rates for induced applicants may seem low given these students' qualifications. The

university's overall acceptance rate for this cohort was 26 percent, implying that marginal applicants in our sample were equally (or somewhat more) qualified than the typical applicant to UM.

Yield rates for students induced into admission by the two treatments are starkly different. The implied yield rate for marginal HAIL students (90 percent yield for induced admits) is also almost triple that for Go Blue Encouragement (32 percent).

We examine characteristics of applicants from the three arms to get a sense of the marginal applicant under each condition. Differences in the characteristics of applicants from the Go Blue Encouragement and control arms are small. That is, the Go Blue Encouragement induces application by students who are much like inframarginal applicants (Appendix Table A.2).

By contrast, there are large differences between HAIL applicants and those from the other arms. They come from high schools where past cohorts of students were less likely to apply to UM (8 percent vs. 11 percent). They are twice as likely to live in the remote Upper Peninsula (14 percent vs 7 percent) and less likely to be from an urban area. Applicants from the HAIL arm have a substantially lower predicted probability of attending a selective college (16 percent vs. 23 percent among control applicants).

Data from the National Student Clearinghouse reveal similar effects of HAIL on nationwide college enrollment as found in Dynarski et al. (2021), though they are less precise due to the smaller sample (Panel B of Table 2.2). Although we cannot reject null effects, the point estimates suggest that in the absence of the intervention, students induced into UM by HAIL would not have attended college at all, or attended less selective colleges.[11] HAIL did not "poach" students from other schools as selective as UM, nor did it increase enrollments at such schools.

None of the point estimates for Go Blue Encouragement is substantively or statistically significant. The Go Blue Encouragement had no impact on enrollment at UM or anywhere else.

[11]The control mean for UM enrollment is higher than it was in the first cohorts, while in the HAIL arm it is about the same. This mechanically produces a smaller treatment effect of HAIL (9 vs 15 percentage points) than in the first two cohorts. This could be explained by many factors, including changes in the definition of the experimental sample, secular time effects, the introduction of the Go Blue Guarantee, or growing knowledge of the HAIL Scholarship.

## 2.6 Mechanisms

In this section, we discuss potential explanations for the pattern of effects just discussed.

### 2.6.1 Does Information and Marketing Change Behavior?

The mailings for the two treatment arms were visually similar and had a similar tone. Differences in marketing and information cannot, therefore, explain the larger impact of HAIL relative to the Go Blue Encouragement on application (20 percentage points larger) and enrollment (7.7 percentage points larger).

We can, however, interpret the 8.2 percentage point difference in application rates between the Go Blue Encouragement and the control group as an effect of colorful mailings, encouragement to apply, and detailed aid information. But this effect on applications did not translate into increased enrollments, which is consistent with a previous literature showing null effects of information interventions on enrollment (Hurwitz and Smith, 2018; Hyman, 2020; Gurantz et al., 2021).

### 2.6.2 Do Burdensome Aid Forms Deter Students from Applying?

HAIL waives aid forms. Perhaps students respond so strongly to HAIL, in part, because they really, really despise aid forms. If HAIL increased applications because it waived paperwork requirements that marginal enrollees found burdensome, we would expect students in the HAIL arm would be less likely to fill out the FAFSA than those in the other arms.[12]

We find that 98 to 99 percent of enrolled students complete the FAFSA, with no significant differences across the three arms. Nor is the timing of aid applications consistent with students in the HAIL arm avoiding the aid form. If anything, HAIL students are quicker to submit their FAFSA applications than control and Go Blue Encouragement students (see Appendix Figures A.2 and A.3). We also find no statistically significant differences in submission of the CSS Profile (Appendix Figure A.4).

[12]We only observe FAFSA filing for enrolled students.

### 2.6.3 Does Higher Aid Lead to a Higher Response?

HAIL students are guaranteed free tuition. Students in the other arms are likely, but not guaranteed, to get free tuition. A large literature shows that students respond to price in their enrollment decisions (Page and Scott-Clayton, 2016). Could differences in the amount of aid going to students in each arm explain the difference in behavior that we observe? We investigate this question by examining the financial aid packages of students in our sample who enrolled at UM, by treatment status (see Table 2.3 and Figure 2.1).[13] Panel A contains results comparing the experimental cohort discussed here; panels B and C contain results for the first two cohorts of the HAIL intervention, for whom we have four years of financial aid data.

Across treatment arms, students who enroll at UM have similar family finances, with nearly indistinguishable (and very low) EFCs. Sample students who enroll at UM overwhelmingly wind up with generous aid. Annual grants average $26,676 for the HAIL students, vs. $25,309 for students from the other arms (see the first panel of Table 2.3). (Because students in the Go Blue Encouragement arm enrolled at the same rate as students in the control arm, and were eligible for the same aid, we pool these two arms for simplicity.[14])

Grants for HAIL recipients are about $1,400 higher than for the other arms. HAIL's effect on enrollment, as discussed above, is 8.6 percentage points, a 49 percent increase over the control group. This implies an elasticity of enrollment with respect to grant aid of about nine.

This elasticity is far larger than those typical in the literature. The closest evidence to our own is Angrist et al. (2022)'s experimental evaluation of a Nebraska scholarship program for disadvantaged students targeting four-year colleges.[15] This program worked through the traditional aid system, with students learning about their eligibility after applying. The intervention doubled grant aid and increased four-year enrollment by 12 percent, an implied elasticity of 0.12.[16] Castleman

[13] We only have aid packages for those who *enroll* at UM.

[14] Separating these two arms produces similar but noisier patterns in the figure and table. We find no statistically significant differences between the aid packages of control and Go Blue Encouragement students (see Appendix Table A.3).

[15] Very few studies have data on the aid *received* by each student, which we need to calculate the elasticity. The two discussed in this paragraph do.

[16] This calculation is based on estimates reported in Figure 1(A) and Table 2 of Angrist et al. (2022).

and Long (2016)'s regression discontinuity analysis of a need-based grant in Florida implies an elasticity of at most 0.4.[17] Our enrollment effects are also larger than those found across a wide range of settings, as summarized by Page and Scott-Clayton (2016).

Although it is impossible to rule out the higher dollar value as the channel through which HAIL affects student behavior, we do not believe it is the primary mechanism.

The strongest evidence on this front, in our opinion: for the initial cohorts of HAIL there was *no* difference in grants between treatment and control students in either their first year of enrollment, or across their four years combined (again, this is only for those who enroll at UM; see the second and third panels of Table 2.3). If anything, students in the HAIL arm had slightly *lower* grants than those in the control arm for those cohorts ($24,207 vs. $24,729 in the first year; $105,735 vs. $106,643 across all four years).[18] Yet, students offered HAIL enrolled at a rate 15 percentage points higher than those in the control group (of which 12 percent enrolled), an even larger absolute and relative effect than we see in the present study (see Figure 4 in Dynarski et al., 2021). Higher grant aid cannot explain this earlier, striking result. We suspect it does not explain the effects for this present analysis, either.[19]

### 2.6.4 The Value of Certainty and the Power of Zero

Insights from decades of behavioral economics research lend further support to our assertion that rational responses to price changes cannot fully explain our findings. Tversky and Kahneman (1986) documented the nonlinear psychological value of certainty, relative to even a very high probability, when it comes to financial reward. Prospect theory suggests that even if 90 percent of the control group got free tuition, pushing that likelihood to 100 percent could have a large effect

[17]This calculation is based on the increase in aid for students eligible for the Bright Futures Florida Academic Scholar award and the effect on four-year public enrollment.

[18]The "business as usual" aid received by the control group has grown slightly less generous over time. In the initial two cohorts, 93 percent of the control group got free tuition, while for the focal cohort of this study it was 88 percent.

[19]Further, differences in realized aid could have affected *applications* only if students could predict aid months before they got their offer letters. Research shows that low-income families are inaccurate in predicting net costs (Avery and Kane, 2004). Yet we see very large effects of HAIL on application rates, not just enrollment. We also see differences in application between the control and GBE students, which, because these groups are eligible for identical aid, is not consistent with students responding to true differences in aid.

on behavior.

The distribution of aid in Figure 2.1 is consistent with a certainty effect. HAIL had very little effect on the *average* grants that students receive, but did reduce their *variance*. The distribution of grant aid for HAIL has a tighter spread, and zero mass below tuition costs. We can also see this in Table 2.3, where the standard error for grant aid is *lower* for the HAIL students than for the other arms ($423 vs $585, see the first panel of Table 2.3). This is true even though the N for the HAIL students is substantially smaller than for the other pooled arms (117 vs 169) and the average grant slightly higher ($26,676 vs. $25,309). The HAIL intervention reduced the variance in grant aid, increasing the certainty students faced in tuition prices.[20]

HAIL's effect could also be driven by the special value of guaranteeing a tuition price of *zero*. Research has established the nonlinear power of a "free" price tag, with consumers perceiving free items as more valuable over and above their reduced cost (Shampanier et al., 2007).

Beyond resolving uncertainty in tuition costs for the first year of college, HAIL guarantees that tuition is zero for four years. Business-as-usual financial aid requires students to reapply annually, learning their net price one year at a time. This difference could further intensify any "power of zero," as well as intensify the effect of shifting from a high probability to a certainty of having tuition covered for four years of college.

## 2.7 Effects of the Statewide Go Blue Guarantee Program

We want to stress that our experiment does not constitute a test of the effect of the statewide Go Blue Guarantee. The Go Blue Guarantee was implemented in 2018 and extended to all students in the state. In our 2019 experiment, therefore, everyone in the sample was potentially eligible for the new program. In the ITT estimates, any statewide effect of the Go Blue Guarantee is reflected in the behavior of the control group.

[20]By contrast, the standard error of the expected family contribution is actually *higher* for the HAIL students than it is for the other arms ($524 vs $415). Under business-as-usual in the aid system, this would lead to a higher variance in grant aid. Instead, the variance is smaller.

Time patterns in application, admission, and enrollment at the University of Michigan for high-achieving students from the state of Michigan shed some light on whether the statewide rollout of the Go Blue Guarantee had any effect on student decisions. In Figure 2.2 we plot these rates separately for low-income and non-low-income students who have SAT scores of at least 1100.

For low-income students, we clearly see the effects of the initial rollout of the HAIL Scholarship for the 2016 cohort. We see sharp increases when the experiment started, of 8 percentage points in application, 2.8 percentage points in admission, and 2.7 percentage points in enrollment. HAIL students comprise approximately a quarter of the low-income population depicted in Figure 2.2.[21] The experimental results for these cohorts (see Dynarski et al., 2021) are roughly four times the magnitude of the time series jumps, which is consistent with the HAIL treatment-group students producing all of the increase.

The raw time-series is also consistent with the pattern of results in the present paper. When the Go Blue Guarantee is implemented for the class of 2018, there is a small increase in application rates but none in admission or enrollment. These descriptive statistics line up with our experimental results: Go Blue Encouragement had a moderate effect on application but none on enrollment, while HAIL had large effects on both application and enrollment.

## 2.8 Discussion

A growing number of states and institutions offer free tuition to students from low- and moderate-income families. In 2020, Democrats campaigned on a promise of free college. At first glance, these policies appear straightforward. Our study suggests that the design of these proposals will have a large effect on student decisions.

We predict that a straightforward, zero-tuition program like HAIL would substantially expand enrollments among low-income students. We expect little effect of policies that rely on the traditional aid process, which does not resolve uncertainty about aid until after application. Programs

[21] Our experimental sample is a subset of the low-income sample because Figure 2.2 is limited to students with a minimum ACT or SAT score, while eligibility for HAIL also depends on GPA.

like these essentially re-brand and promote existing aid and attempt to change student behavior by addressing information barriers. Multiple studies, including our own, now show that just informing students about aid has little to no effect on their decisions (Bettinger et al., 2012; Hurwitz and Smith, 2018; Bergman et al., 2019; Hyman, 2020; Gurantz et al., 2021).

A downside of universal free tuition is that it is expensive, since the subsidy goes to all students regardless of income. At community colleges (which largely enroll students of modest means) a zero-tuition approach would convert what is essentially a policy of free *net* tuition into a policy of free *sticker-price* tuition, providing students greater certainty while requiring little change in per-student spending.

A universal free-tuition policy at four-year colleges would require substantial funding, since they rely on the tuition revenue of full-paying students. These colleges could create *targeted* programs like the HAIL Scholarship. A cheap form of targeting: piggyback on qualification for existing need-based programs such as subsidized school meals or other social welfare programs. Our findings suggest these policies would substantially expand the attendance of low-income students at four-year colleges, where they are currently under-represented.

Our findings are more broadly relevant to the design of social policy. A compelling body of research now shows that requiring recipients to demonstrate eligibility through an application process reduces participation of the most disadvantaged (Currie, 2006; Finkelstein and Notowidigdo, 2019; Herd and Moynihan, 2019). Policymakers should weigh whether efforts to target assistance may have the unintended effect of excluding the targeted beneficiaries. Automatically opting recipients into programs, either through universal eligibility or administrative screening that does not require applicant opt-in, consistently maximizes participation of those with the greatest need.

Table 2.1:
School-Level Summary Statistics by Treatment Arm

| Characteristic | Control | HAIL | Go Blue Encouragement |
|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.13 | 0.13 | 0.13 |
| | (0.13) | (0.12) | (0.12) |
| Southeast school | 0.35 | 0.35 | 0.35 |
| | (0.48) | (0.48) | (0.48) |
| School in UP | 0.15 | 0.18 | 0.15 |
| | (0.36) | (0.38) | (0.36) |
| City school | 0.13 | 0.13 | 0.13 |
| | (0.33) | (0.33) | (0.33) |
| Town/rural school | 0.53 | 0.53 | 0.52 |
| | (0.50) | (0.50) | (0.50) |
| Suburban school | 0.35 | 0.35 | 0.36 |
| | (0.48) | (0.48) | (0.48) |
| Distance of school from UM (miles) | 98.9 | 104.1 | 97.5 |
| | (86.74) | (86.65) | (75.65) |
| UM application rate of school, class of 2015 | 0.07 | 0.07 | 0.06 |
| | (0.08) | (0.10) | (0.09) |
| Average ACT score of school, class of 2015 | 19.96 | 19.92 | 19.89 |
| | (1.85) | (2.06) | (2.07) |
| Proportion of sample students with A or A+ GPA | 0.86 | 0.87 | 0.84 |
| | (0.24) | (0.22) | (0.26) |
| Proportion of sample students with A-, B+, or B GPA | 0.14 | 0.13 | 0.16 |
| | (0.24) | (0.22) | (0.26) |
| Average SAT of sample students | 1260 | 1264 | 1262 |
| | (71.14) | (72.77) | (61.83) |
| Proportion female | 0.56 | 0.55 | 0.57 |
| | (0.35) | (0.36) | (0.34) |
| Proportion under-represented minority | 0.17 | 0.15 | 0.18 |
| | (0.28) | (0.27) | (0.29) |
| Proportion eligible for free lunch | 0.80 | 0.81 | 0.79 |
| | (0.28) | (0.25) | (0.28) |
| Average number of sample students | 3.8 | 3.7 | 3.7 |
| | (3.50) | (3.19) | (3.51) |
| Number of schools | 159 | 159 | 159 |
| Number of students | 610 | 595 | 591 |

*Notes:* All analyses conducted at the school level. Standard deviations in parentheses. Summary index calculated from parameters of an OLS regression estimating the relationship between observable characteristics and a binary indicator for attending a college as competitive as the University of Michigan. "Under-represented minority" includes all students who are Black, Hispanic, American Indian, or Native Hawaiian or Pacific Islander.
*Source:* Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Table 2.2:
HAIL Scholarship and Go Blue Encouragement Treatments and College Choice Outcomes

| Outcome | HAIL | Go Blue Encouragement (GBE) | HAIL vs. GBE |
|---|---|---|---|
| *Panel A. Estimated Treatment Effects on University of Michigan Outcomes (UM administrative data)* | | | |
| Applied to University of Michigan | 0.280 | 0.082 | 0.198 |
| | (0.038) | (0.039) | (0.038) |
| | | [0.354] | |
| Admitted to University of Michigan | 0.096 | 0.025 | 0.071 |
| | (0.036) | (0.035) | (0.037) |
| | | [0.230] | |
| Enrolled at University of Michigan (UM data) | 0.086 | 0.008 | 0.077 |
| | (0.033) | (0.032) | (0.034) |
| | | [0.174] | |
| *Panel B. Estimated Treatment Effects on Enrollment Outcomes (National Student Clearinghouse data)* | | | |
| University of Michigan (NSC data) | 0.089 | 0.010 | 0.080 |
| | (0.033) | (0.032) | (0.034) |
| | | [0.169] | |
| Highly competitive or above (other than UM) | 0.010 | -0.002 | 0.012 |
| | (0.016) | (0.015) | (0.017) |
| | | [0.039] | |
| Four-year | 0.039 | -0.009 | 0.048 |
| | (0.035) | (0.036) | (0.036) |
| | | [0.724] | |
| Two-year | 0.002 | 0.012 | -0.010 |
| | (0.021) | (0.021) | (0.022) |
| | | [0.071] | |
| Any | 0.041 | 0.002 | 0.038 |
| | (0.031) | (0.033) | (0.032) |
| | | [0.796] | |
| *Panel C. Induced University of Michigan Acceptance and Yield Rates (non-experimental)* | | | |
| Induced acceptance rate (admission effect / application effect) | 0.343 | 0.305 | 0.038 |
| Induced yield rate (enrollment effect / admission effect) | 0.896 | 0.320 | 0.576 |
| Number of schools | | 477 | |
| Number of students | | 1,796 | |

*Notes:* All analyses done at the school level. Robust standard errors reported in parentheses. Treatment effect coefficients are from estimating Equation (2.1). The "HAIL" and "Go Blue Encouragement" columns report estimates of $\beta_1$ and $\beta_2$, respectively. Control means are in square brackets. The difference, and standard error of the difference, between the HAIL and Go Blue Encouragement effect coefficients reported in the right-most column are the difference between $\beta_1$ and $\beta_2$. UM application, admission and enrollment are measured in the summer and fall following expected high school graduation. Admission and enrollment are unconditional on application.
*Source:* Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Table 2.3:
Student Financial Aid by Treatment Arm and Compared with the Original HAIL Cohorts

| | Focal Cohort | | |
|---|---|---|---|
| | *Panel A. First Year* | | |
| | Mean | | |
| | Control & Go Blue Encouragement | HAIL | P-value |
| Grants | $25,309 | $26,676 | 0.047 |
| | (585) | (423) | |
| Loans | $1,312 | $956 | 0.213 |
| | (273) | (184) | |
| Proportion with Grants $\geq$ Tuition | 0.880 | 1.000 | 0.000 |
| | (0.024) | (0.000) | |
| Expected Family Contribution | $2,397 | $2,481 | 0.867 |
| | (415) | (524) | |
| Cost of Tuition | $15,960 | | |
| | (132) | | |
| Number of students | 169 | 117 | |
| Number of students in the study | 1,201 | 595 | |

| | Original Two Cohorts | | | | | |
|---|---|---|---|---|---|---|
| | *Panel B. First Year* | | | *Panel C. Sum of Years 1 - 4* | | |
| | Mean | | | Mean | | |
| | Control | HAIL | P-value | Control | HAIL | P-value |
| Grants | $24,729 | $24,207 | 0.360 | $106,643 | $105,735 | 0.720 |
| | (497) | (235) | | (2230) | (1011) | |
| Loans | $1,339 | $1,766 | 0.125 | $5,293 | $7,282 | 0.042 |
| | (202) | (164) | | (772) | (592) | |
| Proportion with Grants $\geq$ Tuition | 0.932 | 1.000 | 0.000 | 0.896 | 0.997 | 0.000 |
| | (0.017) | (0.000) | | (0.025) | (0.003) | |
| Expected Family Contribution | $1,902 | $2,078 | 0.531 | $8,264 | $8,812 | 0.601 |
| | (269) | (206) | | (1220) | (827) | |
| Cost of Tuition | $14,672 | | | $66,199 | | |
| | (403) | | | (398) | | |
| Number of students | 237 | 465 | | 193 | 347 | |
| Number of students in the study | 1,978 | 1,932 | | 1,978 | 1,932 | |

*Notes:* Analysis done at the student level. Includes only students enrolled at the University of Michigan full time for full first year (panels A and B) or full time for all four years (panel C) and who have financial aid data reported. Standard errors are clustered at the school level. Includes zeros for students who receive no aid. "Grants" includes all institutional and departmental scholarships and grants, federal grants, state grants and scholarships, private scholarships, and other departmental aid. Expected family contribution is capped at the cost of attendance, as determined by the University of Michigan (includes tuition, fees, books and supplies, room and board, transportation, and personal expenses). Original two cohorts refers to the students studied in Dynarski et al. (2021), who first enrolled in the fall of 2016 or 2017.
*Source:* Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

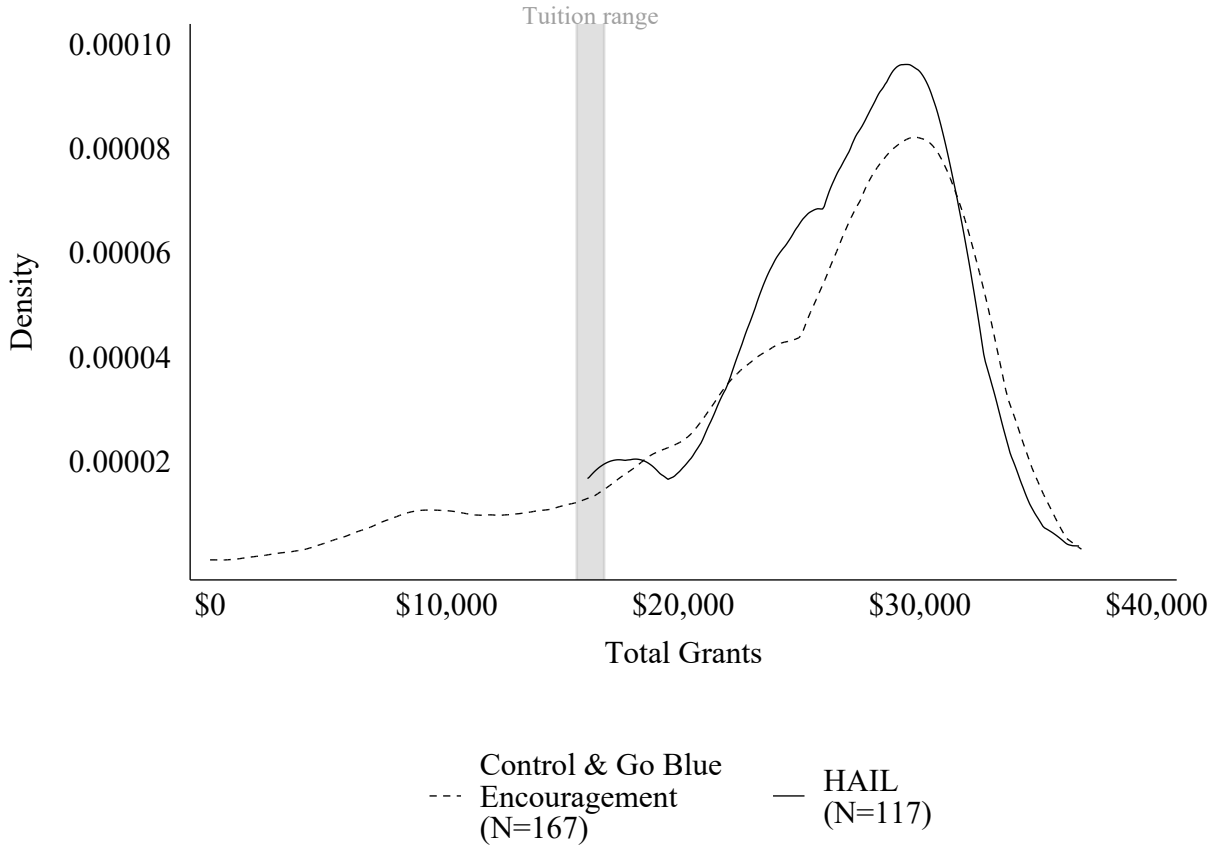
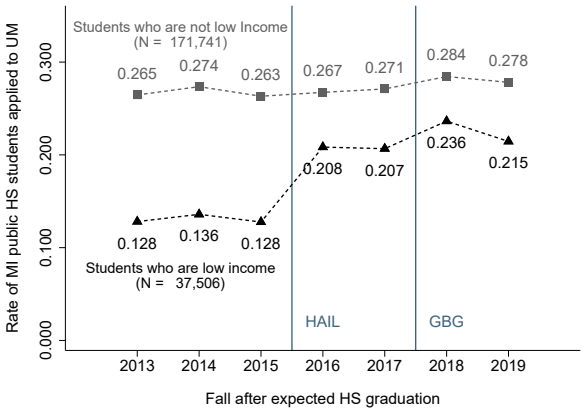


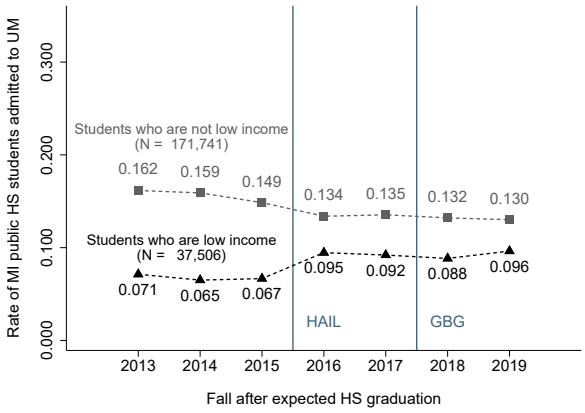

Figure 2.1:
Distribution of Total Grants Awarded to Students, by Treatment Arm

*Notes:* Figure plots the distribution of total grant aid by treatment group, among students who were enrolled full time for the full first year, and who have aid data reported. Control and GBE are combined. Grant aid includes all institutional and departmental scholarships and grants, federal grants, state grants and scholarships, private scholarships, and other departmental aid. The gray bar represents the in-state tuition range for lower-division (first and second year) programs of study (ranging from $15,520 to $16,071 depending on the school or college each student is enrolled in). For simplicity, we refer only to tuition. Unlike many other institutions, the fees at the University of Michigan are very small ($214.19 for this cohort's first year). The distributions are not statistically significantly different, with an exact p-value from a two-sample Kolmogorov-Smirnov test of 0.244.
*Source:* Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

Panel A. Application to University of Michigan (UM)




Panel B. Admission to UM




Panel C. Enrollment at UM

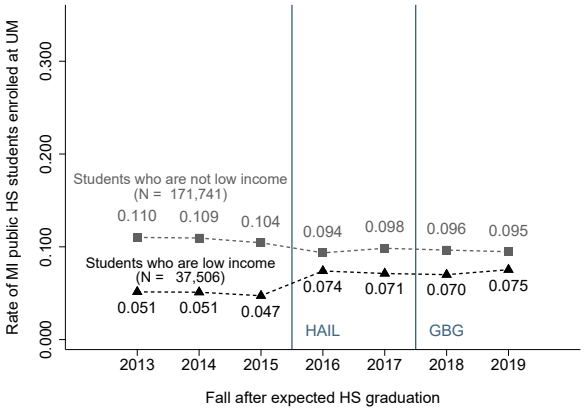



Figure 2.2:
University of Michigan Application, Admission, and Enrollment Rates
for High-achieving Michigan Public High School Students

*Notes:* Figure plots the rate of UM application, admission, and enrollment, or the number of students who applied (or were admitted/enrolled) divided by the number of students in each 11th grade cohort in Michigan public schools. High-achieving students are students who scored at least a 23 on the ACT before 2016, or a 1100 or the SAT in 2016 or later, to correspond with the HAIL academic criteria. UM announced the Go Blue Guarantee in 2017 and implemented it in January of 2018.
*Source:* Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

# CHAPTER 3

# Following in their Footsteps or Avoiding Their Mistakes: The Role of Older Siblings in Shaping College Decision Making[1]

Students' decisions about what pathways to pursue after high school have profound impacts on their future economic, demographic, and social outcomes. These choices do not happen in a vacuum: where students grow up, their social networks and resources, their schools, and the policy and institutional contexts they are exposed to all shape their postsecondary choices and contribute to inequality in educational attainment. The reliance on informal social networks for information and decision-making strategies is a well-established source of inequality in educational attainment (Perna, 2006). The role of parents is often emphasized while less attention is paid to other members of students' family networks. Siblings are often used in research as a form of identification, used to isolate intergenerational mobility, parental investment, or to control for family circumstances. However, the unique role older siblings play in supporting their younger sibling's educational attainment is often underemphasized. Older siblings can serve as key bridges for information on the college application process between students and parents without college experience (Ceja, 2006), and recent causal evidence highlights that siblings have a direct effect on students' college going and enrollment choice, influencing the college choices of their younger siblings (Altmejd et al.,

[1]This project was approved by the University of Michigan's Health Sciences and Behavioral Sciences Institutional Review Board (under study research ID HUM00169471).

2021). However, we know relatively little about this relationship, and what makes it distinct from other resources.

Students, particularly those from families with low incomes, rely on their informal social networks (families, friends, and peers) to navigate this complex and consequential decision (Alvarado, 2021; Ceja, 2006; Holland, 2010). They often face several barriers to accessing higher education including academic preparation, family support, accurate information about financial aid, or complexity of the application and financial aid processes (Attewell et al., 2011; Cox, 2016; Dynarski, 2003; Page and Scott-Clayton, 2016; Roderick et al., 2011). All of these factors contribute to students from families with low incomes going to college and completing a four year degree at lower rates than their higher income peers, and more often attending institutions of a lower selectivity than their qualifications would allow (Bailey and Dynarski, 2011; Chetty et al., 2020). While policy and institutional factors, as well as formal institutional networks such as teachers and school counselors, are important in shaping the choices students have available to them and their decision-making process (McDonough, 1997; Stephan and Rosenbaum, 2013), institutional agents often amplify, rather than reduce, existing inequities (McDonough, 1997).

Students therefore rely on those they trust to help them make decisions, but not all students have access to comparable resources and support from their social networks in this process. Parents with knowledge of the college application and enrollment process are more equipped to help their children through the complex bureaucracy related to college enrollment (Lareau and Weininger, 2008; Pfeffer, 2008), and students whose parents have a college degree and students with greater economic resources are more likely to enroll in and complete college (Bailey and Dynarski, 2011; Pfeffer, 2018).

In this paper, I use qualitative interviews with high-achieving high school students from families with low incomes to explore the unique role that older siblings play in shaping the postsecondary decision making of their younger siblings: what makes the support of older siblings meaningful (both how they support, and whether or not that support resonates) and what might explain heterogeneity in the effect that siblings have on their younger siblings' pathways? Qualitative data

are particularly well suited for capturing these heterogeneous networks that are meaningful in students' lives, as well as non-traditional family structures that may not show up in obvious ways in many quantitative data sets (for example, stepsiblings or half-siblings with different last names, or students who split their time between multiple households). The students in the interview sample are drawn from an intervention aimed at reducing economic inequality in postsecondary education attendance, the HAIL Scholarship study (Burland et al., forthcoming; Dynarski et al., 2021). Many policies aimed at reducing inequality in educational attainment, including the intervention that these students are sampled from, are targeted towards increasing college-going and completion among students from families with low incomes; therefore, understanding the resources that students from families with low incomes in particular use to make their decisions is crucial to adequately targeting policies to meet their needs. Further, understanding the supports students need to navigate this process could inform programs or policies aimed at providing more equitable institutional supports.

In the remainder of this paper, I will show that the support provided by siblings is distinct from other support, defined by three characteristics: (1) they are externally relevant to the current postsecondary landscape (recent and applicable to the rapidly changing postsecondary system), (2) internally relevant to the personal circumstances of the student, and (3) are delivered based on a long-term, high-intensity relationship. I outline how the support provided by siblings is often distinct from support provided by other key parts of a students' network, including parents, counselors, and peers. Further, I explore heterogeneity in the relationship's influence. I find that siblings' influence on students' decision making varies on several dimensions; primarily, how the student's and their sibling's identities align, whether the sibling's postsecondary experiences were positive or negative, and the closeness of their relationship. Regardless of how connected students feel to their siblings' postsecondary experience, having a sibling navigate postsecondary education before them leads to support through information, time, and material resource sharing that simplifies the process for the younger sibling. In fact, many older siblings also feel an obligation to share the information they learned along the way to ensure their siblings do not make the same mistakes

that they did. Students without older siblings receive information from other trusted sources, but often struggle to find resources that have the same impact as those provided by siblings.

I argue that the social capital accessed from siblings has distinct characteristics that make it unique to this relationship, providing resources and support that are otherwise difficult to obtain. I find that older siblings serve as a unique resource that contributes to the educational decision making of their younger siblings. While many policies and institutional factors play an important role in increasing college access, awareness of the relationships that affect student decision-making is important for understanding patterns of educational attainment.

## 3.1 Background

The decision of what path to pursue after high school is a challenging phase of a young person's life. The decision is highly complex, the outcomes uncertain, and, for many students, it is an experience that their parents are unable to fully help guide them through. Students face substantial uncertainty, even more so for students from families with low incomes. Students face financial risks, including both initial and unanticipated future costs (DeLuca et al., 2021; Goldrick-Rab, 2016; Page and Scott-Clayton, 2016). Additionally, they face constraints on time availability: while most students from families with low incomes recognize the potential value of a college degree for their future economic outcomes (Avery and Kane, 2004), they often encounter personal restrictions that require them to move more quickly into financial stability (Holland and DeLuca, 2016) Finally, students face personal risks to going away for school, potentially away from social networks and support systems (Armstrong and Hamilton, 2013; Morton, 2019). While human capital models of educational choice and status attainment models of educational stratification can explain some of the economic inequality in educational attainment, they often do not account for variation across groups in the ways students access information to determine what a "sensible and reasonable" path might be for them (McDonough, 1997; Perna, 2006).

One of the ways that students navigate the uncertain and complex decision about what to do

after high school, and taking the necessary steps to achieve it, is through their social supports (Roderick et al. 2011; Stephan and Rosenbaum 2013). Students with college-educated parents are more likely themselves to attend and complete postsecondary education than those whose parents have not received a bachelor's degree (Pfeffer, 2008). While students from middle- to upper-income households are often surrounded by informal college discussions throughout their lives, both at home, in their communities and networks, and at schools; this is less likely to be the case for students from low-income households (Lareau and Weininger, 2008). Lareau and Weininger (2008) highlight that for many middle- and upper-class families, educational decisions are often a "family affair," with parents arranging everything from college visits to conversations with family friends who have gone to particular colleges or degree programs. Parents with knowledge of the system, namely, those parents who have themselves completed a college education, are able to employ that knowledge to help their children navigate the necessary steps (Hamilton, 2016; Pfeffer, 2008). Parents use this "strategic knowledge" (Pfeffer, 2008) to help their children achieve at least the same level of education that they themselves completed, if not surpass their own educational outcomes. However, parents with college experience themselves might have a narrow perspective, or struggle to provide guidance on the rapidly changing system of higher education. And while all parents may rely on institutional resources to provide recent and applicable information about the postsecondary decision-making process, parents who do not have a college degree especially rely on the school to provide those supports (Lareau and Weininger, 2008).

Students rely on their social capital, or their network that enables and communicates resources, information, and access to forms of cultural and human capital, to navigate complex decisions. This may be particularly relevant for consequential decisions about postsecondary education (Holland, 2010; McDonough, 1997). Schools could be sites for developing a more equitable process that relies less on the household economic and educational stratification, and more on the goals of students. However, schools in fact often magnify these existing differences in cultural capital, by assuming students come to them already with a given level of knowledge and skill about the process (McDonough, 1997). In fact, the amount of cultural capital at the school level, specifically

parent involvement at the school through discussions with the student about their education and parent-initiated school involvement overall at the school, is itself associated with inequalities in educational attainment (Perna and Titus, 2004). In a study of a college-coaching program, Stephan and Rosenbaum (2013) find that one-on-one, long-term trusting relationships with students centered around college advising that is proactive, rather than re-active can be successful at improving college-going outcomes among those least likely to attend a four-year school. This happens specifically through improving completion of key actions along the way between a student's desire to go to college, and actual enrollment, namely: college applications and financial aid forms (Stephan and Rosenbaum, 2013). However, this is a challenging model to scale given the resource constraints on counselors. Counselors are assigned to many students and hold more responsibilities than just college advising. Further, many counseling relationships rely on student-initiated meetings, leaving students who are less likely to reach out without the support they need. Importantly, the capacity of counselors is related to the socioeconomic status at the school, meaning those schools most in need of this one-on-one, personalized coaching model are less likely to have the capacity to scale it without outside resources (McDonough, 1997; Stephan and Rosenbaum, 2013). Students need direct guidance on both the postsecondary decision as well as the steps to get there; and this often comes from long-term, trusted relationships and college-specific advising, which is often not accessible to students at school.

Social capital is often thought of as beneficial primarily to students from more resourced social classes, who have access to wealthier and closed networks that provide resources and information for educational attainment. This primarily refers to parents and the connections parents are able to broker between students and institutional resources (Coleman, 1988; Holland, 2010; Perna, 2006). However, social capital is also employed to share resources and support within communities underserved by institutions, in particular communities of color, immigrant communities, and low-income communities. In a qualitative study of primarily African American or Black students from families with low incomes, Holland (2010) finds that the students accessed social capital from their family, friends, and school personnel, relying on these resources for information and support;

however, without families and communities who were highly educated, students lacked informal, personalized opportunities to learn about college. Importantly, because of relatively closed social networks both for them and their more privileged peers, students were not aware of the limitations of the resources and information they did have access to. This led to inequality in college going, despite similar college aspirations (Holland, 2010).

Similarly, research among Latina/o high school students found that students leaned on advice from their personal networks, often choosing to apply to or enroll at schools where they already had a connection, and that this could be both good and bad (Pérez and McDonough, 2008). Attending college is, as some theorize, a very costly "purchase" of human capital; however, full information about that purchase is not available to students until after they have already enrolled (Perna, 2006; Winston, 1999). This is especially consequential for students who are the first in their family to go to college, and therefore do not necessarily have parent advice to draw on. In these cases, reliance on the experiences of those close to you may be especially consequential, allowing students to witness someone else "trying out" the experience ahead of them. However, this can have negative consequences. Resources or experiences shared by personal networks are influenced both by the individual's experience as well as their relationship with the person they are sharing the information with (Perna and Titus, 2004), which can lead to incomplete and biased information. This is relevant to all parts of a students' network that may influence their decision making; however, may be most consequential for resources that are given more weight. Therefore, both the relative influence of the sibling relationship, in reference to other resources, as well as the quality of the support provided by the sibling, may be consequential for inequality.

Inequality in social capital and networks contribute to stratification in college attendance and completion. First-generation college students in particular often rely heavily on their social networks, especially given limitations in college advising available at high schools that serve low-income or otherwise populations traditionally excluded from higher education (Holland, 2010). Having close college-bound friends does positively impact college going; however, its impact varies by race and gender (Alvarado, 2021). Siblings might have a particular impact on educa-

tional stratification. However, siblings have been underexamined as a mechanism contributing to inequality in postsecondary educational attainment. Sibling effects have been a staple of quantitative research on social stratification and economics to document family dynamics. Siblings have been used for identification using sibling fixed effects to control for family circumstances, and to identify intergenerational mobility through sibling correlations. Finally, there is an extensive literature in economics on the effects of birth order timing on child outcomes including academic achievement, earnings, and noncognitive outcomes (e.g. Black et al., 2018). The literature on birth order timing has found evidence that eldest siblings have higher assessed cognitive and noncognitive outcomes, and that the effect of birth order varies by gender of the eldest sibling. Some identified mechanisms for this birth order effect include environmental factors and parental investment (Black et al., 2018). Despite this research using siblings for identification, whether siblings themselves serve as a mechanism through which intergenerational mobility occurs is understudied. Research on educational decision making has largely combined siblings with family more broadly, focusing primarily on the role of parents in this process. There are a few studies that suggest focusing on siblings as a distinct mechanism contributing to inequality in postsecondary educational attainment is worthwhile.

For the younger siblings of first-generation college students, older siblings serve as a personalized source of information on the college experience, and can serve as key sources of information for students navigating the process (Ceja, 2006). There is a small amount of causal evidence that younger siblings are more likely to enroll in college and choose a higher quality school if older siblings do it first (Altmejd et al., 2021). The authors speculate this is because siblings can serve as a "higher-touch" and sustained intervention, which is particularly important for families without parental knowledge of the college process. However, reliance on social networks and cultural capital is not always positive (Holland, 2010). First-generation students and students from families with low incomes often lack the financial resources or the cultural capital to approach college as a time for exploration; and therefore, approach the postsecondary decision more in terms of career training, constraining their options (Armstrong and Hamilton, 2013; Holland and DeLuca,

2016). While some of the literature on postsecondary decision making characterizes decisions not to attend postsecondary institutions that match students' academic achievements as "irrational," that does not mean these choices are not thoughtful or meaningful. When students do not have family resources as a safety net, the risks of going away to college may increase, regardless of the potential long-term benefits (Armstrong and Hamilton, 2013; Hamilton, 2016).

Inequality in educational attainment is driven by a variety of factors including parental resources, institutional resources, financial support, preparation and aspirations, and unequal access to cultural social capital. Successful resource and support systems must be able to effectively deliver key information and support to students to help them evaluate the fit of a given course of action for their individual goals. In asking what unique role siblings play in supporting their younger siblings through the postsecondary decision-making process (both in whether and where to pursue postsecondary education), this paper advances our understanding of both the way students make decisions, and contributions of the social network to growing educational stratification.

There is clear evidence that social networks matter for decision making, and that closed social networks contribute social reproduction and growing inequality; however, whether siblings have a distinct influence in this process is not obvious. On the one hand, it is possible that given the totality of a student's network, sibling support is a redundant resource. It is possible that peer and school relationships matter much more than a student's older sibling, or that there is nothing new that the older sibling provides beyond what their parents have already provided. However, it is also possible that siblings matter a lot to a student given their proximity to the students' individual circumstances, above and beyond what peers, school staff, and parents can provide. In this case, siblings may be a distinct mechanism through which social reproduction occurs, and inequality grows. Without direct attention to the older sibling as a resource, it is impossible to distinguish the broad family effects from individual participants in the decision-making process. By focusing on siblings as a distinct resource, separate from family, school, or peer support, this paper contributes to our understanding of the ways in which social networks contribute to social reproduction, educational inequality, and economic stratification.

## 3.2 Data and Methods

### 3.2.1 Research Context

This project is positioned within an ongoing randomized, controlled trial (RCT) that is aimed at learning how to increase the enrollment of students from families with low incomes at selective institutions (Dynarski et al., 2021). The HAIL Scholarship Study, started in 2015, evaluates the effects of a personalized, no-strings-attached, four-year guaranteed scholarship offer to the University of Michigan (UM), the flagship and only highly-selective in-state institution. The scholarship is offered to students while they are still in high school, based on administrative data both on students' economic need and academic achievement, with the goal of increasing both application and enrollment at the University of Michigan. Students in the intervention sample are in one of three treatment groups, students receiving the HAIL Scholarship, students receiving personalized encouragement and information about a university-wide policy (the Go Blue Guarantee) to meet full financial need for enrolled students (this intervention group is called the "Go Blue Encouragement"). The remaining students are in the control group. The RCT finds that students who receive the HAIL scholarship are twice as likely to apply and enroll at the University of Michigan than students in the control group, and that these students are otherwise likely to attend a less selective four-year or two-year institution (Burland et al., forthcoming; Dynarski et al., 2021).

The students in my interview sample are from the sample of students eligible for the HAIL Scholarship study from the class of 2020. These students are all from families with low incomes, identified by their eligibility for free- or reduced- price lunch at school, and are considered high-achieving based on a combination of high school grades and SAT score, meeting the qualifications for the HAIL Scholarship set by the University of Michigan.

### 3.2.2 Interview Sample

Students were selected for the interview recruitment sample using a stratified random sample of the HAIL Scholarship study sample. I used random selection within experimental randomization

blocks to both preserve the integrity of the experimental design, and as a part of an effort in the broader qualitative study to speak to processes and mechanisms of decision making.[2] Appendix B has more detail on how students were sampled for participation in the qualitative study. Using addresses provided by the Michigan Department of Education at the end of a students' junior year of high school, these students were mailed a letter inviting them to participate in February of their senior year of high school. Students were recruited using this method several times over the course of their senior year. First round interviews were conducted between February and July of their senior year.[3] Most students were interviewed across two time periods (1) during their senior year of high school, as they made their decisions (and after the treatment group students received the HAIL scholarship); and (2) during their first year after high school.[4]

My final interview sample consists of 36 students. Table 3.1 describes the characteristics of the students interviewed. Region and urbanicity are based on the location of the students' school as of the end of 11th grade and defined by the Center for Educational Performance and Information (CEPI). A student's SAT score and grade average are from the SAT test they took in 11th grade in school. The test is mandatory as the 11th grade assessment; therefore, most students in a Michigan public school take the test at this time. The sample is mostly White[5] (n=23) and female (n=23).[6] Students in the interview sample have an average SAT score of 1241, by design since the cutoff

[2]In the broader qualitative study, our team interviewed students and parents in two additional HAIL Scholarship study cohorts. Each interview sample was selected using stratified random sampling within experimental randomization blocks. Purposive oversampling of certain experimental blocks was done in response to heterogeneous treatment effects by region and urbanicity found in the experiment. More detail on sample selection as well as efforts to preserve experimental integrity can be found in Appendix B.

[3]All 36 students were interviewed at least once. The first 12 students were interviewed in person prior to the COVID-19 pandemic. I followed up with 8 of them in May and June to check in about the ways in which COVID-19 might be affecting their plans for after high school. I then conducted follow ups with 29 of the 36 students in winter 2021.

[4]There was a two month pause due to COVID-19. The first 12 interviews were conducted in person at a location of their choice (e.g. their home, coffee shop, public library). Remaining interviews were conducted by phone or Zoom.

[5]I intentionally capitalize White here and throughout when describing a racial group. There is no widespread agreement on this practice; however, as Ewing (2020) writes, "[Whiteness] is a specific social category that confers identifiable and measurable social benefits" and should be capitalize it to not "contribute to its seeming neutrality."

[6]The HAIL Scholarship sample itself is skewed female. Additionally, female students were more likely to respond to the call for interview participants. Administrative data are used when describing the full recruited sample, as these are the data that I have for both those interviewed and not interviewed (although using identity measures like race and sex from administrative data has its flaws, they are unfortunately all I have prior to the interview). However, when discussing student stories in the text of the paper, I report the gender and race that each student self-identified using an open-ended survey question.

for the HAIL Scholarship sample was between 1100 and 1150, and most report an A or A+ grade average in their high school classes. Students were spread across rural, urban, and suburban areas across the state, mostly in the southeast, west, or central Michigan; however, there were three students who lived in northern Michigan.

In addition to these characteristics from the administrative data provided by CEPI, I also have college outcomes provided both from the Michigan Department of Education's SAT records and the University of Michigan Office of Enrollment Management admissions data. About half of the students sent their SAT scores to UM (n=15) and fewer sent their SAT scores to MSU (n=11) when they took the SATs in school. While I did not have this information prior to the interview, 25 students in the interview sample ended up applying to UM, 17 were admitted, and 11 matriculated.

Of the 36 students interviewed, 22 (61 percent) have an older sibling who has lived with them and is ahead of them in school, and 16 (44 percent) have a sibling who went to a four-year college.[7] There is no agreed upon way to define "first-generation" college students (e.g. Redford et al., 2017; Toutkoushian et al., 2018). While 18 students (50 percent) have at least one parent with a bachelor's degree, only 15 (42 percent) have a parent with a bachelor's degree from an institution in the United States. And only 13 (36 percent) have a parent who lives with them for at least 50 percent of the time that has a bachelor's degree. None of the participants live full time with two parents with a bachelor's degree.[8] Additionally, 12 students (30 percent) have a parent who is a first-generation immigrant to the United States. At the time of the interview, most students in my sample planned to go to college immediately after high school, about 86 percent (31 out of 36).

I am sensitive to the fact that my interviews only represent the stories of those who opted in:

[7]Here I have only included students who have a sibling who lived with them at any point in time, and who is ahead of them in school because those are two factors that make a sibling distinct from another peer. This excludes two students who have older siblings that have never lived with them, one student who has twin older sisters in the same grade, and one student who has an older brother still in school receiving transition only services. I consider anyone the student refers to as their sibling, including step- and half-siblings.

[8]I specify whether the student has a parent with a bachelor's degree from an institution in the United States, because one of the key ways parents can be helpful in navigating the complex decision-making process is through strategic knowledge of the system (Pfeffer, 2008; Hamilton, 2016), which one acquires through navigating the system. While parents with bachelor's degrees outside the United States may be equipped to help in other ways, they are still at a disadvantage in helping students navigate the complex search, application, and financial aid process in the United States.

my position as a researcher at an academic institution may have shaped both who chose to respond to the interview call and how students approached the interview. While the interview guide was developed in a way to not privilege conversation about college specifically, and the recruitment materials emphasized that we wanted to talk to students regardless of their plans for after high school, my position may have affected students' reactions to the questions. I do not presume that the results of my study will be representative of all high school students in Michigan, or even all students in the HAIL Scholarship sample. However, the stories from my respondents do uncover important patterns that I will highlight in this paper.

### 3.2.3 Interview and Analytic Methods

Students were interviewed using a semi-structured narrative interview protocol (see DeLuca et al. (2016) for more on this method). This ensured the same topics are covered by each student but allows the student to lead the conversation. Students received $50 for participation in the interview, which ranged in length from 82 minutes to 159 minutes. Topics covered include students' family circumstances, disruptions in their schooling, K-12 school experience, career goals, college application processes, and knowledge of college costs and college quality, and their application process. Students are asked to list all the places they applied, or plan to apply, and to weigh the pros and cons of each place. The second interview asks students to describe their post-secondary decision-making processes (potential barriers, alternatives they considered, tradeoffs they perceived among options), list all of their admissions decisions, describe each of their financial aid packages, and learn how their transition went. Interviews are transcribed by a trained transcription professional.

The analysis was iterative. Though I started from a semi-structured interview guide with key guiding research questions, initial thematic coding was done without a structured codebook. After thematic analysis, I developed an analytically focused coding scheme that allowed me to code each transcript using ATLAS.ti. Finally, by comparing coded segments across participants, as well as building a student profile within each participant, I was able to maintain the complexity of each students' story, while also identifying patterns across the participants in my sample. Identifying

themes and coding for those identified themes will always be subjective to the researchers conducting the study and another researcher may have picked up on different things in the analysis or chosen to code the data in a different way. However, to improve on the trustworthiness of the analysis, I use several different methods including triangulation using administrative data, and cross-checking analysis with respondents during the second interview. The names used throughout are pseudonyms that are selected by the participants themselves to tell their story, to protect the participants' confidentiality. Race and gender reported through the findings are self-identified by the participant in an open-ended demographic survey collected at the end of the interview. I have largely preserved students' words in the quotes presented; however, at times I have trimmed quotes for brevity or to preserve students' confidentiality.[9]

## 3.3 Findings

### 3.3.1 What Makes Older Sibling Support Meaningful?

As students make decisions about what to pursue after finishing high school (both whether to go to college or not, as well as where and how), they receive many signals about what they should pursue after high school, and often this information can be conflicting or even contradictory. All of my participants revealed that when they are searching for information about what to do and how to achieve it, they often begin by seeking out information from those close to them. These are individuals who they have regular contact with and whose information on the postsecondary landscape is recent and applicable to their needs and experiences. Siblings have a unique position to provide students with resources on their postsecondary decisions; however, the literature has often focused on other informational resources such as parents and counselors.

While a few of the students I interviewed did have a parent or a school counselor who provided continuous, deep support through the process, this was not the norm. Most students reported that their parents and school counselors provided surface level help with logistics and moral support

[9]When quotes are trimmed or edited for any reason, I have indicated this using square brackets.

through the process, but not more in-depth decision-making support that many students felt they needed. Parents, while they may know their child very well, including their goals and priorities, they often lack relevant information to support students as they navigate their postsecondary decision. For example, Alfanzo is a student from southeast Michigan whose parents immigrated to the United States from Iraq explains, "It was kind of hard for them to like tell us what to do, in regard to like college and like high school and stuff because they [did not] really live college and high school here, they lived it over in Iraq." Even students whose parents did attend college in the United States often saw their parents' postsecondary experience or information to be outdated and less applicable to their own circumstances. Christina is White a student from a small, rural community in northern Michigan. While her mom did go to college, Christina described her mom's knowledge about college as outdated and no longer very useful for her. Asked if anyone at home helped her through the application and decision-making process, she shared, "No, just because like nobody- like it's been so long since my mom went to college that like everything had changed, like since she experienced it, and then, my dad didn't go to college, so he didn't know anything." In addition to parents and counselors, some students also get support from their peers. Like parents, peers can provide support and share resources, but lack the relevant and complete information due to having not yet gone through the process.

Except for a few counselors, students largely described their counselors and teachers as providing surface-level advice and guidance, without personalized assistance. Consistent with the literature on college counseling, many students told me that their counselors are spread thin and unable to provide the kind of long-term and personalized advising that many students need to successfully navigate the college search process. Lily, a White student from rural northern Michigan attends a small school of under 100 students. She explains that her counselor wears many hats and is ill equipped to provide personalized college advising, since that is not her primary role, "I guess the thing is she [. . . ] did all kind of counseling. Since she was such a broad counselor, she didn't necessarily help with a lot of specifics. She was just the one person for everything. It was hard because I feel like what she specialized in wasn't what a lot of kids might have needed or I

needed."

In summary, the parent relationship has the intensity required for personalized information and advice; however, parents often lack relevant information on the process. Counselors, on the other hand, may have more recent information on the postsecondary education landscape; however, their relationships with students lack the intensity necessary to provide personalized and ongoing support through the process. In contrast, the relationship between siblings provides on different dimensions. Compared to the other sources of information in a students' life, siblings often can provide support on all of the dimensions that make for a strong resource: the relationship is frequently a long-term, trusting relationship (relationship intensity); siblings often have more recent information (external relevance); and unlike peers or teachers, siblings come from the same home environment and financial circumstances, making their experiences more likely to be directly applicable to a students' life (internal relevance).

#### 3.3.1.1 Relationship Intensity

The long-term nature of the sibling relationship, as well as the regular exposure to each other's lives, is one aspect of the sibling relationship that makes it unique. The students in my sample highlighted some ways they learned from their older siblings simply by being there as their siblings went through it. For example, Britney is a student from southeast Michigan. Her parents immigrated to the United States when she was quite young, and she has three older siblings. Her older sisters had to navigate the postsecondary system with very little guidance from their parents; however, her sisters went on to become a dentist and a doctor. Her brother is finishing at the UM Ann Arbor and is starting in medical school. Britney also aspires to be a doctor, and had a whole plan mapped out for when and how she would apply, and what she needed to do while in college to achieve her goals. When asked how she learned everything she needed to formulate a plan, she exclaimed, "from my siblings of course." She then went on to explain, "The whole family, it's when they were applying, it's like the whole family was applying because we were also involved in their application. I learned from them and hopefully, when it's my time, they can help me out

too."

Just having that long-term exposure to their experiences gave her information that helped make her journey easier and helped her formulate a plan early on. She explained that her siblings were her key source of information on college going. When she was making decisions, they would all talk about it over dinner, and her siblings helped her reassure her parents that she was ready to move away from home and go to the University of Michigan Ann Arbor. When asked who was the most influential in her college decision-making, she said it was her siblings, "Just because I live with just my siblings, just because I look up to them the most."

#### 3.3.1.2 Internal Relevance

Similarly, unlike peers or other adults in their lives, siblings often have a deeper understanding of a student's circumstances, having gone through it themselves. They often face similar constraints in their postsecondary decisions, including financial circumstances and parental expectations. In some ways, the older sibling may serve as a preview for the younger sibling, allowing them to see how a certain pathway might play out for them. For Sally, a White student from southeast Michigan, the process of learning from her brother's experience unfolded less through direct advice and guidance, but instead she learned from his example. Sally's mom is a single mom who struggled financially throughout their lives. Sally explained that college was never a question for her, that her mom was happy with whatever path she chose in life, as long as it started with a college education. In the end, Sally was choosing between going away to the flagship UM Ann Arbor campus or attending her local branch campus and living at home. She explained that the University of Michigan was always her top choice, because she "just heard so many like good things about it. And like I've visited my brother a couple of times and I just really liked it." However, she was concerned about moving away from home and starting college. She said that her brother, who attends UM Ann Arbor, and his friends that he connected her with, put her at ease: "I've talked to like a few people that already in college and they say it's like so much fun, so much better than just being at home all the time. I've talked to like my brother about it."

Her brother was able to ease her concerns about moving away from home and encourage her that she really could handle being away at school – that it would be fun. In addition to leading the way through the college experience, having her brother at the same school also conferred other material benefits, including having access to a car on campus and having his apartment to go to when she and her friends wanted somewhere to hang out. While Sally said that her brother was not very helpful when she was making her list or filling out her college applications, these small and less obvious ways of leading the way made a big difference in Sally's postsecondary decision.

Unlike the reassurance that Sally's brother provided her to follow a similar path, Jeffrey learned which possible roadblocks to avoid by watching his sister struggle on journey to a college degree. Jeffrey is a White student from a rural town in south-central Michigan. His older sister attends community college about an hour away. She did not start there, and her experience figuring out what she wants to do influenced his plans. Coming from similar financial circumstances and experiences, he wanted to avoid the challenges she faced. He shared:

> So, I guess just the fact that is the longer I can stay out of paying student loans, the better. My sister is in college so, because she couldn't decide what major she wanted to be. So, without knowing that she switch to a major and the loans that she has to pay also factored into me wanting to know what I wanted to do before, that way, I don't, I want to say make the same mistake, but do the same, go down the same path, knowing that financially it was not easy.

Both Sally and Jeffrey recognized themselves in their siblings' experiences and watched to see how it might be for them. For Sally, she realized that her brother was happy and successful where he was, and that convinced her that she could also make that pathway work. For Jeffrey, knowing the experience that his sister had changed the way he approached his college decision.

#### 3.3.1.3 External Relevance

Finally, siblings have more recent information about college and the process to get there. Having recently gone through it helps students both get more recent information than they may get from a

parent, and also helps students to narrow down the large volume of information they receive about their postsecondary options. May considers her aunt to be like a sister to her, closer to her age than her parents are and living nearby. They have had an extended, close-knit relationships that in many ways resembles that of a sibling. May explains that her parents, who did not go to college, could not provide much other than moral support. However, her aunt, having more recently gone through the college search process herself, was able to share more accurate information. May said, "Most helpful was my aunt. She would help me with the schools, with – learn about what to look for in schools. She would help me edit my essays and like how to write them more personal to myself [. . . ] because she had experience as well like that. She was like an older sister guiding me with that." Further, both Britney and Jeffrey only really considered applying to schools that their siblings had attended.

Consistent with other research on students from first-generation households going through the college application process (Ceja, 2006), I find evidence that older siblings also play an important role in teaching parents about the process so that they can better help the younger siblings. Many students highlighted that their parents were better able to help them fill out financial aid forms and look at college options because they had already gone through it with the older siblings. This eases some of the burden on the younger siblings as they navigate this complex system of administrative bureaucracy.

The intensity of the relationship, and the internal and external relevance of the information shared are characteristics that define the distinct support that siblings provide as a resource for their younger siblings. Unlike other resources, siblings provide a more concrete picture of what the student might expect if they pursue a particular path. Further, students receive practical help from their siblings who have gone through the college search process before them, using information that is more current than other adults in a students' life. In addition to concrete advice and guidance, older siblings often model this process for their younger siblings, going through the motions and testing out a pathway before their younger siblings make their own choices. However, this does not happen evenly across my participants. Similarly, quantitative research has found substantial

heterogeneity in the relationship between siblings' college outcomes. What might explain this heterogeneity?

### 3.3.2 Following in their Footsteps? Heterogeneity in Sibling Influence

Prior research on the causal impact of older siblings on their younger siblings' college trajectories has found heterogeneity in their effect. This is not surprising given that sibling relationship dynamics vary considerably, as do their lived experiences. Importantly, siblings are just one voice in a sea of voices telling students what they should do; therefore, the weight a student puts on their siblings' advice or experience varies considerably across students. However, here I unpack several dimensions that may shape the heterogeneity in the relationship that we see. How much a student takes from their siblings' experience varies across a few primary dimensions. The first dimension of sibling influence is how "similar" or "dissimilar" a student feels to their sibling. The more connected a student feels to the way their sibling experiences the world, the more likely the student is to see their siblings' outcomes as possible, or even likely, outcomes for themselves. The second dimension is related to how close the siblings are. Of course, families are all different. In families where siblings are particularly close, spending time together and engaging in ongoing communication, the influence that the older sibling has over the students' journey is more pronounced. Finally, the influence of siblings, in particular the direction of the influence, varies based on the student's perception of their older sibling's experience as positive or negative. This may be an evaluation of only pieces of a siblings' experience, and certain parts of their sibling's journey may be more or less salient than others. For example, a student may see that their sibling picked a good career path (positive), but their sibling started at a school that was not a good fit for them (negative).

There are three primary ways that a student's pathway can follow that of their sibling. They can either reproduce the same pathway their sibling took, diverge completely from the path of their sibling, or they can modify their sibling's experience, choosing to learn from the roadblocks their siblings faced or experiences they do not want to replicate. Having their sibling as a resource allows students to see, prior to experiencing it themselves, what might lie ahead if they follow a certain

path, allowing them to make a more informed choice about their next steps. The common threads documenting why this relationship is a distinct resource (the intensity of the relationship, internal and external relevance) show up as common threads throughout these heterogeneous responses to sibling support and information. In the next three sections, I will walk through examples of each of these possible responses to older siblings' experiences. Then, I will conclude with highlighting commonalities; that is, the support that all students receive from older siblings who are involved in their decision making.

#### 3.3.2.1 Students Who Reproduce Their Siblings' Pathway

Students who consider themselves to be very similar to their sibling, and whose sibling had a positive experience, may choose to reproduce the pathway that their sibling took through postsecondary education. In some cases, this is obvious, and their siblings' influence is particularly salient throughout the interview. In other cases, this is more subtle, with no salient point at which the student chose to take the same path; however, the student still follows the same steps and strives for the same goals.

Ciara is a White student from a rural area in northern Michigan. Her mom does have a college degree, and she has two half-brothers who are older than she is. Despite their age gap, Ciara looks up to her brothers as role models, and leans on them for advice and guidance. Even before college was a consideration for her, Ciara's brothers shaped her schooling experience. She participated in the same sports that they did, learned from them which classes to take AP versus dual enrollment, which electives to avoid, and which teachers were helpful and less helpful. They even shaped how she approached school throughout her life. As Ciara put it, "I put a high premium, I guess, on my academics because my brothers did really well. And so I like made it a point of kind of doing either equal or better to them." Given the intensity of their relationship, she was able to watch closely what they did and decide how she might follow them, seeking out advice and guidance they could provide because they had already gone through school themselves. When it came to her college decision, she again relied on their experiences. Her mom thought that she would thrive

at a smaller school, while she thought she could make it at a larger university, like the state's two largest public universities: Michigan State University and the University of Michigan. After receiving her acceptance letters, she was ultimately deciding between the University of Michigan and a smaller school, she turned to her brothers' guidance on whether attending a larger school would be something she could handle. Not only did she rely on them to help her understand what the experiences might be, she valued their input on how she might do at each of these places:

> My middle brother was - he thought I would be able to handle it just fine. And it was mainly about whether or not I should apply to be in the residential college[10]. And he - and I asked him like why he didn't. And he said 'probably because I just all wrapped up in like getting the application done and excited about potentially going there, and I didn't really think about that.' And he thought that it was a good opportunity.

Ciara placed a premium on her brother's experiences when deciding what to pursue. And not only did she end up on a similar path, but she sought their advice when deciding what to do – knowing they would understand what might work for her.

Sometimes, however, following in siblings' footsteps happens in more subtle ways. Lily has an older brother. While he had already finished college by the time she started to consider her postsecondary options, and they did not always have a close relationship, she now talks to her brother almost every day. Her brother attended school for computer engineering, and now works as a computer engineer. Lily wants to go to school and study computer science, although she has had no opportunity to explore computer science in her very small high school. I asked Lily how she got interested in coding and computer science. She explained, "So, my brother actually got a bachelor's degree in computer engineering and that's where like definitely a lot of my interest has stemmed." She went on to explain that her brother invited her to her first hackathon while he was in college and she was in high school, and that's where her interest in coding was first initiated and sparked her interest in pursuing programming in her future career.

[10]A residential college is a smaller living-learning community intended to create a smaller school feel within a larger college campus (see https://lsa.umich.edu/rc/prospective-students.html).

> I've attended like several hackathons which is like an event where you make a project with code. And I like taught myself how to build websites. And I've just always had interest in just like making programs and – especially nowadays, like it's such a demanding job. Like there's so many places that are looking for it because like technology is rising so much. And it's a really good paying job. You don't have to get more than a bachelor's degree.

Without the exposure to her brother, she may not have had this pre-college experience with coding or computer science. Her brother also showed her what it takes to get a job in the field. This experience, while less explicit than Ciara's, shaped her college considerations. While some students chose to or ended up reproducing their sibling's path, other students did choose to learn from their siblings, and modify their path to better meet their needs.

#### 3.3.2.2 Students Who Modify Siblings Pathways to Better Support their Goals

Students who see themselves as similar to their siblings, but whose siblings had a negative experience or negative outcomes, may choose to learn from their siblings' mistakes in an attempt to more successfully achieve their goals. For these students, they see the outcome that their sibling ended up with from a given action or experience as the outcome they would likely experience as well. This is because they see themselves as similar to their sibling, so they expect to experience a certain pathway in a similar way. This includes expectations of similar financial aid offers, social experience, and academic challenges, among other things. When students' siblings have a negative experience, they choose to make modifications to their sibling's pathway to avoid the mistakes they saw their siblings make or to avoid outcomes that they or their siblings perceive to be negative. This observation and modification is possible only because of intensity of a sibling relationship that allows students to regularly communicate throughout their sibling's experience, or at least, watch the experience unfold firsthand. Avery is a Hispanic student from west-central Michigan. Her parents immigrated to the United States before she was born, and she will be a first-generation college student. She has several older siblings, including two sisters and an older

brother. She and her sister are particularly close. When asked to define what success means to her, Avery described her sister: the independence her sister has established is a goal that Avery has for her life. While her sister's current life is successful, according to Avery, none of her siblings had an easy journey through postsecondary education. She explained,

> I've had my brother he did [a four-year] then it became too much, but he dropped out and then my other sister did [a four-year] so she dropped out and then she switched to community college. [. . . ] and then my other sister she also did community College she was saying that like you can literally get the same benefit of community college from like a university, but you're just in for two years.

Most of what Avery knows about the cost of college comes from her siblings' experiences. Her sister switched from a four-year school to a community college because the cost was prohibitive. Avery explained what she knows about how much college costs: "I don't know how much exactly college classes are. I do know they're a lot [. . . ], because my sister she did [a four-year], but she was only able to last like a semester a year before she had to switch out to community college, because it was just way too much money for her to handle or like for her to pay off." With this in mind, Avery decided that no matter what, she wanted to start at a two-year school and then transfer to get her bachelor's degree.

When she was in high school, Avery's sister was able to provide personalized guidance about the pathway she believed would be a good fit for Avery. Her sister suggested she enroll in her high school's early middle college program, which allows students to begin taking college classes in their junior year, and graduate in five years with both a high school diploma and an associate's degree. While Avery was hesitant at first, her sister ultimately convinced her that it was a good idea:

> The main person who helped me like decide though was just like my sister, she really pushed me into it, and she kept mentoring me about it, and so yeah. It wasn't really anything like, it wasn't my friends who persuaded me to do it, it was just more my

> sister who was saying that like, in the long run it's going to help you out so much more financially and stuff so, I guess that kind of pushed me to do the program.

Avery was influenced by her siblings' negative experiences with cost and debt, as well as their positive experiences in community college. Through their guidance and advice, and learning from their experiences, she was able to choose a path that would help her achieve her goals while avoiding the financial risks that her siblings incurred along the way.

Other students may choose to modify their siblings' pathway, even if their sibling's experience was positive, because they do not consider themselves to be similar to their sibling and have different priorities. When students see themselves as less similar to their sibling, they may want to avoid certain pathways or experiences that their sibling prioritized; however, they do still learn from their siblings' experiences in meaningful ways. This includes practical knowledge about the application process, such as how to fill out financial aid paperwork, scholarships to look for, or characteristics of an academic program to prioritize, as well as colleges to look at or consider. Sully is the daughter of Korean immigrants from southeast Michigan. Neither of her parents went to college; however, her sister who is two years older does attend the University of Michigan. Sully has two sisters, one older and one younger. While Sully was around 9 or 10 years old, her family moved around a few times while her parents switched jobs. She explained that from her perspective, these moves hit her at a particularly important phase in her social development that they impacted her more than her sisters:

> We were in different parts of life, because my sister, she's two years older than me and she's, my little sister is four years younger. So, I don't think the moves impacted my little sister as much, because she was kindergarten or through a big chunk of it and then my older sister, she already had settled into where she wants to stand in a social setting. So, I was, I don't know. I don't want to assume anything, but I feel I was impacted by the social ramifications the most, so I think it's made me much more introverted. I feel I value social interactions less than my sisters do.

Given their different personalities and interests in the college social life, Sully believes she might need something different in a college experience.

While Sully believes her personality and priorities are different from her sister, she still used her sister and her sister's experience to evaluate where she might be happiest. When choosing where to apply, she applied to the three schools that her sister applied to, and then added a school that her sister recommended to her: a highly selective institution out of state that has a reputation for high quality science programs. Given her career interests, her sister suggested that another highly-selective institution out of state that has a strong reputation in the field Sully is interested in, might be a good fit for her. Ultimately, Sully was deciding between the University of Michigan and the other highly selective institution, and turned to her sisters' experience to help her make a decision:

> I basically weighed my perception of how freshman year went for her because she's a junior right now [...]. So, like seeing from it, I don't know, I feel she let herself go a little too much in terms of her grades, but seeing that and then, [...] judging from my perception of how U of M has been for her and then also seeing from an outsider's perspective what other students are on campus are experiencing. I have a few friends from church and pastors from high school, who also went to U of M and seeing them is basic, is how I sussed out how U of M might be for me.

In addition to her concerns about the social life at UM, Sully also worried about relying on her sister too much if they went to the same place. Her sister has taken on a lot of responsibilities at home, including helping her parents navigate the layers of bureaucracy that exist in the United States in a language other than their native one. When it came to her college essays and her financial aid application, it was Sully's sister who guided her through the process. She explained that at UM, she feels like she would continue to rely on her sister: "I would have had the space to grow, I guess and learn new things, because even from a little child, I feel I depended on my sister a lot. I wouldn't be really willing to go out of my way to meet other people and establish something for myself, if I knew that she would be there." Ultimately, she decided that UM, seen through the eyes of her sister, "wouldn't really fit" with her personality, and that a smaller highly selective

institution out of state would be a better fit. She said, "I feel a lot of people who are similar to me go there a work hard, play a little less hard thing and it's smaller." Because her sister went before her, she had time to process and think about how her goals and personality fit within a given institutional culture. Without that experience of her sister, she may have had to do more trial and error to figure out what would work for her, but she was instead able to process that information while still in high school with enough time to make a stronger first choice.

#### 3.3.2.3 Students Who Diverge from the Experiences of their Siblings

Instead of reproducing or modifying the paths that their siblings took, other students choose to follow diverging paths from those that came before them. These students do not relate to their siblings or see themselves as different from their siblings. They choose to chart a different path because they have different goals, desire a different outcome, or perceive their siblings' experience as negative. Further, these students may pick up on other signals from other people or institutions that better align with their priorities or goals. In some cases, this may mean that students choose to go to college, even if no one in their family has gone before them. In other cases, they may see their older sibling as the one who chose a divergent path from the rest of their family or community and choose to diverge from their siblings' example to stay on a similar path as others in their community, rather than following in their siblings' footsteps. One example of this diverging pathway is Dorothy, a White student from west-central Michigan. Dorothy has several older half siblings who live with her and her mom. Her mom did not finish high school, and none of her older half-siblings went to college before her. While her father did finish college, he was not in her life until very recently and therefore Dorothy did not turn to him for guidance on the process.

Despite her siblings not continuing their education after high school, Dorothy has always wanted to go to college. She wants to achieve career goals that are different from what her family members have achieved, explaining, "my family, they're not like [. . . ] that fortunate when it comes to jobs, so like I've always used them as a basis, like I want to be better." She goes on to share more about her diverging goals and priorities:

> I'm just the first one out on my mom's side to like even think about going to college or graduating high school. But in my head, like, I don't know, I've always thought like I want to be that graduate. [. . . ] So yeah, I just want to be proud of myself. Like, I want to set higher standards for myself, and my family do and I want them to be proud too.

Instead of relying on her sibling experiences and advice, Dorothy leaned on her high school counselor and her peer network of college-bound friends for advice and support in the process. Further, her older brother, who never went to college himself, still provided some amount of material support through the process. In addition to encouraging her goals, her brother would grab mail she received from colleges and slip it under her door, texting her about it so that she could avoid conversations with her less supportive sister. He also helped by brainstorming with her and editing her college essays as she prepared her applications.

The attempt at diverging from a sibling's pathway is not always straightforward. In some cases, students tried to diverge from the pathways paved for them by their siblings; however, faced similar barriers and constraints that ultimately led them down a similar path. Nineteen is a Hispanic student from rural central Michigan. He intended to go to college, and even applied to a few. He has an older sister and a younger sister. His older sister lives at home, works at the local grocery store, and has taken some classes at the community college on and off for years. Neither of his parents went to college, and he wanted to start off at a four-year school rather than do what his sister did and enroll at the local community college. Unfortunately, when he was accepted to just a few colleges, none of the financial aid packages he was offered would allow him to afford school without support from his family, who was unable to provide him with any financial support. He felt as though he no longer had choices, and instead followed in the footsteps of his sister, enrolled in a few classes at the local community college and got a job where she worked. He ultimately did not finish the semester at the community college and is working to regroup and figure out how to apply again next year. He still intends to diverge from the path laid before him; however, for now, he is still figuring things out. Nineteen is an example of students who may want to take a different path, in part because they do not consider their siblings path the right one for them but end up with similar

choices due to the similar constraints and barriers that siblings face.

### 3.3.3 Common Threads: Support from Siblings Regardless of Path

Heterogeneity in sibling influence leads students into one of the three possible paths: either reproducing, modifying, or diverging from their siblings' experience; however, regardless of the relationship between students and their older siblings, all the students in my sample took something from their older siblings' experiences. Rae's considers herself to be quite different than her brother. Her brother followed friends to school further away from home, but ultimately realized he did not want to study what was offered where he had enrolled. He dropped out to move back home, not wanting to waste money on a degree that would not get him where he wanted to go. Rae, however, is very sure on what she wants to pursue for a career, and knows that academically she will have the right options at the school her brother had tried out. While her brother ultimately did not stay enrolled, Rae's brother helped reassure her that the community of students there is very open minded and accepting, and she therefore would not be ostracized for her sexuality, something she was nervous about in moving away from home. Rae's brother was able to provide advice personalized to Rae's unique concerns, based on his recent experience with that institution. Further, given their close relationship, Rae knew that they were different enough that she would likely be able to achieve a different outcome.

Even students charting their own path still received things like practical advice about applications and financial aid, career and major guidance, help editing essays, and moral and emotional support. For example, many students also received small pieces of advice and guidance from older siblings who supported their diverging goals. Annie, a White student from rural eastern Michigan, learned from her brother who just graduated college how to evaluate whether her intended program of study is accredited at a given university and how to research job placement rates. This is advice he was able to provide both due to their ongoing communication, his knowledge of her goals and priorities, and his recent experience navigating the postsecondary education system. Jeffrey, who was informed by his sister's experience taking on a lot of debt by changing majors and switching

schools, was able to live with his sister for free while attending community college, allowing him to avoid taking on debt at least for his first two years of school. He was concerned about debt primarily due to his sister's experience. His sister also shared her experience at various colleges, to inform his transfer process after he finishes two years at community college. In many cases siblings were able to provide this simple but important guidance and support that made it easier for their younger siblings to make decisions.

Thus far, I have presented findings on the way that younger siblings discuss the role of their older sibling in their postsecondary decision. However, my participants who have younger siblings also share their perspective on their role as an older sibling and resource to their younger siblings. Many of my participants who are themselves older siblings shared the sense of responsibility they feel in shepherding the success of their younger siblings. This includes advising siblings on things like what classes to take, and what activities to participate in, to passing on knowledge they wish they knew when they were searching for colleges. In some cases, it also included advising their parents on what they should help their younger siblings with when the time comes. Marian is an Asian student from west-central Michigan. Her parents immigrated to the United States just before she was born and had little knowledge of the institutional structure of higher education in the United States. They consistently emphasized going to a "good college" without much concrete guidance on what that should look like. Her mom would not take her to visit colleges before she applied, suggesting she just apply to the well-known schools and then pick the best one she gets into. She only got to visit Michigan State University once she was accepted and was selected to interview for a scholarship, which was eye opening for her. She described this experience:

> I'm like after like going to MSU and seeing everything. I'm like, 'Mom, you should have let me go to a college.' I'm like telling her [my brother] has to go to at least one college before he gets to choose everything, because I had no baseline of what everything looks like in a college. [. . . ] For me, I think it was better to see everything, like how big it was like up close, because MSU is like really big and everything. They have a lot of stuff there. And I like, "That's really big compared to the map."

Because she felt as though her college search experience would have been better had her mom let her visit schools ahead of time, this is one key piece of advice that she is sharing with her brother to help in his college preparation. She said, “And then that’s one thing I would like to say to my brother, this thing, ”You have to go to a college before you like choose one. And like visit one.” She felt obligated to advise her brother as he prepares to apply to college, and to share with her mom what would have made her experience better, to make sure that he has a better experience selecting a college than he did. She explained this role she’s taken on, “I’m the first one to go to college. So, I’m the one like guiding my brother through all of this. Like telling him like what classes like he should take.” As the first one to experience college, she is the one to advise her brother on what the process is like.

The older siblings in my sample also provide a framework to consider the policy implications of these findings. In particular, the guidance and information they highlight that they were missing in the process, and what they felt compelled to share with their younger siblings, can help us design equitable institutional supports. For example, Jalyn, a Black student from southeast Michigan with one younger brother explained that being a first-generation college student, she had few people to turn to for advice and guidance. She felt as though her high school did not prepare them for the whole range of options available to them, including likely financial aid at schools that may look expensive (high sticker price) but offer a lot of need-based financial aid (low new price). In the year following her high school graduation, she worked with her former high school counselor to provide guidance for students early on in their college search, providing them with information about their options as well as a personal perspective on the experience. This research question itself is deserving of its own separate analysis, certainly both siblings have important stories to tell about the importance of this relationship; however, Jalyn’s experience poses an important question about how to effectively design policies aimed at increasing college access equitably.

## 3.4 Conclusion

Students' social networks serve as important resources in their decisions about postsecondary education. However, the influence of social networks is also a key source of inequality in educational attainment. The literature often focuses on the role of parents and peers, as well as institutional resources provided in school. The unique role of siblings as a resource, distinct from parents and peers, is understudied. There is initial evidence that siblings matter (Altmejd et al., 2021; Ceja, 2006). In this paper I unpacked the characteristics that distinguish the resources siblings provide and the heterogeneity in their influence. I documented the distinct characteristics that define siblings as a resource for their younger siblings as they navigate their postsecondary education decisions. That is, it is a long-term, high intensity relationship, and resources that are both externally relevant to the current postsecondary landscape, and internally relevant to the personal circumstances of the student. This leads to support from siblings in the form of information, time investment, material resource sharing, and leading by example to show their younger siblings one possible pathway (and the resulting outcomes). Notably, some sources of heterogeneity come from the similarity of the student to their older sibling, the closeness of their relationship, and whether the older siblings' experience is perceived as positive or negative which leads students to follow different pathways using sibling support and resources. Regardless of the pathway, using siblings as a resource simplifies the process for younger siblings to navigate in order to achieve their goals.

This paper serves to provide a characterization of this relationship, something previously missing in the literature. It documents what makes this relationship distinct from other resources that students access, why these characteristics are important for supporting student decision making, and what might be contributing to the heterogeneity in the influence of siblings. I show that the social capital available to students as they make their postsecondary decisions comes from both tapping their networks for support and resources, as well as having the opportunity to observe those around them directly going through the process, namely siblings. I find support for the conclusions made by Holland (2010) about the importance of acknowledging social capital within disadvantaged groups, and of the potential importance of closed or small social networks to ed-

ucational inequality. Given limited social resources in a student's network, reliance on siblings, while necessary for students to make decisions, may exacerbate existing inequalities given the narrow experiences of those individuals. The identified characteristics of the support provided by older siblings should guide policies aimed at helping students make postsecondary decisions. Further, families are complex, and these complex networks may provide support beyond the parents or family economic circumstances generally. Siblings, including step- and half-siblings, provide important support in the transition to postsecondary education and decisions about educational attainment. Siblings may be a key mechanism contributing to persistent intergenerational economic transmission, or in pushing forward intergenerational mobility. By studying only parents or considering only the role of parent educational or economic circumstances in contributing to inequality, we ignore an important source of heterogeneity in the lives of students from families with low incomes.

Future work should use a larger sample size to look systematically at when this relationship matters most, and when it is less consequential. This would help us better understand the policy implications of the sibling relationship: in what context is the experience and influence of siblings reduced through institutional resources that could reduce inequality? Additionally, in this analysis I consider the role of all individuals that the student considers to be an older sibling. However, future research would benefit from understanding whether there is a difference in the role of siblings by family complexity: that is, do half- and stepsibling relationships exhibit similar or different qualities? While in my sample I document this as a clear relationship between students and their older siblings, in the absence of a sibling, a non-sibling tie may be able to provide similar support if the students' relationship with them has similar characteristics. This was the case for May, who received a lot of support from her aunt in the college decision making process. As described in the findings, May characterized her relationship with her aunt as *similar to* a sibling relationship, and her relationship with her aunt clearly displayed many of the same characteristics of a sibling relationship. This suggests that while these relationship characteristics may be most readily displayed in the sibling dynamic, they can be replicated in non-sibling relationships in certain circumstances.

Finally, this paper focused almost exclusively on the perspective of the younger sibling. Understanding the perspective of the older sibling serving as this resource for their younger siblings would be a valuable contribution to this literature.

In one direct next step to this analysis, I am working on a sibling link in the administrative data to be able to directly speak to policy spillovers, both from the HAIL Scholarship and other interventions. This will help link the mechanisms discussed here to quantitative evaluation in the entire population, speaking directly to the policy implications of this relationship dynamic. In this qualitative evaluation, I show that older siblings can have profound influence over the postsecondary paths that their younger siblings pursue due to their unique relationship and support characteristics. The support provided by this relationship in the educational decision making process varies considerably depending on the siblings' experiences, and the characteristics of their relationship. The experiences that shape siblings' influence can be both positive and negative. That is, negative experiences of the older sibling are further compounded as they shape the decisions of the younger sibling. Alternatively, interventions that positively influence the older siblings' experience may pass on to the younger sibling. Therefore, positive interventions may have spillovers beyond their sample, as older siblings pass on their positive experience to their younger siblings. Qualitative research allows us to understand the "black box" driving the effects of interventions, and understand mechanisms resulting in policy spillover effects.

Beyond policy spillovers, this work can inform the development of policies that provide the necessary support needed to guide large, complex, and consequential decisions. The characteristics that make sibling support so distinctly meaningful should contribute to making institutional supports for postsecondary decision making more robust to the needs of students. Beyond college access policies, these influential factors may extend to the take-up of other social supports. In order to appropriately target public policies, and assess their impact, it is essential to understand the complexity of the resources that students access as they navigate their postsecondary decision.

Table 3.1:
Sample Characteristics of Students Interviewed compared to those Selected for Recruitment

| | Interviewed | | Selected for Sample | |
|---|---|---|---|---|
| Characteristic | Number | Proportion | Number | Proportion |
| Region | | | | |
| Outside Southeast MI | 22 | 0.61 | 42 | 0.64 |
| Southeast | 14 | 0.39 | 24 | 0.36 |
| Urbanicity | | | | |
| Town or Rural | 14 | 0.39 | 28 | 0.42 |
| City | 8 | 0.22 | 24 | 0.36 |
| Suburban | 14 | 0.39 | 14 | 0.21 |
| Student Demographics | | | | |
| Female | 23 | 0.64 | 38 | 0.58 |
| Male | 13 | 0.36 | 28 | 0.42 |
| Black | 5 | 0.14 | 7 | 0.11 |
| Asian American | 5 | 0.14 | 6 | 0.09 |
| Hispanic | 4 | 0.11 | 10 | 0.15 |
| White | 23 | 0.63 | 47 | 0.71 |
| American Indian, Native Hawaiian, or Alaskan Native | * | * | 5 | 0.08 |
| Student Academics | | | | |
| Grade Average: A+ or A | 22 | 0.61 | 58 | 0.88 |
| Avg. SAT Composite Score | 1241.11 | | 1253.64 | |
| HAIL Study Treatment Status | | | | |
| Control Group Student | 12 | 0.33 | 22 | 0.33 |
| Student Received HAIL Scholarship | 12 | 0.33 | 22 | 0.33 |
| Student Received Go Blue Encouragement | 12 | 0.33 | 22 | 0.33 |
| Number of students | 36 | | 66 | |

Notes: Table reports information from administrative data, not information self-reported in the interview; therefore, demographics may differ slightly from what is reported in the findings. Race and ethnicity are not mutually exclusive categories so they may not add up to the total number of interviews.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

# CHAPTER 4

# Varying Contexts, Varying Consequences: Geographic Inequality in Educational Attainment[1]

Rural educational attainment has continued to gain attention in recent years, with headlines such as "The Rural Education Crisis" and "Those Left Behind" signaling students in rural areas are being left behind in the push for greater access to higher education and improved completion (e.g. Colleen Campbell, 2019; Marcus and Krupnick, 2017). An increasing number of high school graduates are attending some form of postsecondary education, including rising enrollments in bachelor's degree programs, however, these gains have not occurred equally across the U.S. population. Public school students in the United States are distributed across place, with thirty percent of students living in rural or urban areas, and the remaining forty percent living in suburbs (National Center for Education Statistics., 2016). Despite higher high school graduation rates, rural high school graduates attend college at lower rates than their suburban peers (U.S. Department of Education, National Center for Education Statistics, 2014) and are less likely to attend a college that matches their academic achievements than are their urban and suburban peers (Byun et al., 2012). Reducing inequality in college access and completion has long been cited as a goal of local, state, and federal policy intervention; however, the geographic differences in the barriers students

[1]This research result used data structured and maintained by the MERI-Michigan Education Data Center (MEDC). MEDC data is modified for analysis purposes using rules governed by MEDC and are not identical to those data collected and maintained by the Michigan Department of Education (MDE) and/or Michigan's Center for Educational Performance and Information (CEPI). Results, information, and opinions solely represent the analysis, information, and opinions of the author and are not endorsed by, or reflect the views or positions of, grantors, MDE and CEPI or any employee thereof.

face in their pursuits of postsecondary education are often overlooked. Given that most research is conducted within urban areas, we know little about the specific barriers facing rural youth in their pursuit of postsecondary education and how these vary from those faced by students in urban and suburban places.

College degrees result in many benefits to students and communities including higher earnings (Chetty et al., 2017; Zimmerman, 2014; Hout, 2012) improved job quality and stability (Hout, 2012), demographic outcomes such as delayed marriage and childbearing (Hout, 2012), and increased civic engagement (Ahearn et al., 2022). Where students go to college also matters for their outcomes. More selective institutions often have lower net-cost to students from families with low incomes and racially minoritized groups, those least likely to attend schools that match their academic qualifications (Chetty et al., 2017; Dynarski et al., 2021; Hoxby and Avery, 2012). These schools support students with more resources and produce higher returns including graduation rates and long-run earnings (Bound et al., 2012; Chetty et al., 2017). For these reasons, some policy makers are eager to increase equity in overall college attendance and completion, as well as equity in the selectivity of institutions attended. However, effective policy responses cannot be one-size-fits-all solutions; instead, policy should be designed to meet the needs of target communities, and those needs may vary by place. In one policy example, an evaluation of a free tuition policy intervention in Michigan found heterogeneous effects by place. This intervention was aimed at increasing highly competitive college attendance among high-achieving students from families with low income and found that rural students were much more responsive to the intervention than were suburban or city students (Dynarski et al., 2021). These findings raise important questions about how the barriers may differ in different geographic contexts and what made this particular policy intervention so successful. What factors contribute to the underlying heterogeneity by place in college attainment? Understanding how inequality varies by place allows us to design more effective policy interventions that adequately target the distinct needs of students.

In this paper, I describe gaps in postsecondary educational attainment between urban, rural, and suburban communities using student-level longitudinal data from the full population of Michi-

gan high school students. Using several recent high school cohorts, I document rates of college attendance, college selectivity, and bachelor's degree completion overall and within subgroups, providing updated estimates for urbanicity gaps in college attainment.

I find large differences in the characteristics of students and schools across rural, suburban, and urban areas in Michigan, including the racial composition of these places, concentration of economic disadvantage, and the options students have for postsecondary education close to home. Thirty-six percent of students from suburban high schools enroll in four-year institutions compared with 33 percent and 28 percent of students in rural and city high schools, respectively. Bachelor's degree attainment gaps are similarly large: 26 percent, 22 percent, and 17 percent for suburban, rural, and city high school students, respectively. Strikingly, I find that students traditionally disadvantaged in higher education have similarly low rates of educational attainment regardless of where they live; however, students in rural areas from more traditionally advantaged groups—White, higher income, and more academically prepared students—have substantially lower rates of college attainment than their suburban and city peers. However, this finding requires a more careful conclusion. There is less racial and economic inequality in educational outcomes within rural areas than there is within cities; however, this lower inequality does not come from improved outcomes among the more marginalized students, who are relatively disadvantaged in their educational attainment regardless of their geographic location. More careful attention to policies increasing access and completion for these students is warranted. Using a regression analysis to control for observed differences between rural, suburban, urban areas, I find that these observed characteristics—including student demographics, academic achievement, postsecondary choice-sets, and school and neighborhood compositions—can account for the observed geographic gaps.

While these results should be taken as descriptive rather than causal estimates, the importance of each factor suggests key areas for future policy to address to better target the distinct needs of students. Specifically, the college options students have near their homes and what their communities look like appear particularly important in accounting for the rural-suburban gap in four-year and selective college attendance, while academic preparation as well as race, income, academic

preparation, and the characteristics of the high schools students attend appear particularly important in accounting for the city-suburban gap in four-year college attendance and bachelor's degree completion.

## 4.1 Background

In the United States, rural areas have lower rates of postsecondary attainment than cities and suburbs. Fewer adults in rural communities of the United States have bachelor's degrees compared with adults in other areas (Lumina Foundation, 2019). In an investigation of rural-urban-suburban differences in college-going outcomes nation-wide, Byun et al. (2012) find that rural high school graduates from the 1992 graduating cohort enrolled in college at lower rates than their suburban and urban peers: seventy-four percent compared to eighty-two percent and eighty-four percent in suburban and urban areas, respectively. The paper finds even greater gaps in college completion for rural students than those for entry (Byun et al., 2012). These estimates, however, are for the United States as a whole. State-by-state, there are differences in the make-up of rural communities. Further, the policy context has changed substantially over recent decades, meaning changes may have occurred over the more than two decades since the data for this study were collected.

Rural and urban communities experience many unique challenges in their educational attainment and transition to adulthood. For rural students, there are well documented barriers in accessing social services and education deserts, where students have limited access to postsecondary institutions (Byun et al., 2012; Klasik et al., 2018; Smith et al., 2013). Students from rural areas are more likely to be in schools with fewer counseling resources and with lower achieving peers, or peers that have less information on college going (Lee et al., 2017; McDonough, 1997), and often have lower academic preparation (Byun et al., 2012; Roderick et al., 2011).

Scholarship on institutional inequality and the effects of persistent economic disadvantage on inequality in student academic achievement and educational attainment has often focused on urban areas, identifying the barriers often faced by students living in urban communities (e.g. Roderick

et al., 2011; DeLuca et al., 2016; Stephan and Rosenbaum, 2013). Students in urban areas experience inequality in academic achievement due in part to consequences of racial segregation, with Black children regularly segregated into communities and schools with fewer resources, higher rates of poverty among their peers, and teachers with less experience (Matheny et al., 2023; Reardon, 2016; Reardon and Owens, 2014). In Michigan, Black students are highly concentrated in urban areas, particularly in Southeast Michigan in Detroit and Flint, with White students living in suburban areas surrounding cities and spread throughout the rural areas in the state. Therefore, urban areas in Michigan face challenges stemming from historical and present-day racial inequality in schools, neighborhoods, and community resources as well as the resulting concentrated socioeconomic disadvantage. These challenges, and their consequences for student educational outcomes, differ from the barriers faced by students in rural communities. What are the different factors that may contribute to inequality in college attainment, and how do these factors differ across place?

### 4.1.1 Postsecondary Choice-sets

Where students live has implications for the postsecondary options that they have available to them as institutions are not evenly distributed. Across the United States, students in low SES areas and communities with lower educational attainment are least likely to have nearby postsecondary institutions. The more college options students have, the more likely they are to attend, further emphasizing the point that college attendance varies by location (Turley, 2009).

Klasik et al. (2018) defines education deserts as "geographic areas where students either do not have access to broad-access, public college option" and match deserts as these areas that "do not have access to a college that is academically matched to their academic credentials." This research on the effects of education deserts has found that overall education deserts lead students to travel further away from home to attend postsecondary education; however, match deserts lead students to attend colleges closer to home that are less selective than their academic preparation would allow (Klasik et al., 2018). Rural students are more likely than their city and suburban

peers to "undermatch," or enroll at an institution that is less selective than their credentials would allow (Hoxby and Avery, 2012; Smith et al., 2013). Undermatch has implications for completion. Students at more selective institutions have higher degree completion rates as well as greater long-run earnings, and there is both descriptive and some causal evidence that these economic payoffs are particularly high for low-income students who are least likely to attend (Bound et al., 2012; Brand and Xie, 2010; Chetty et al., 2017; Zimmerman, 2014). Therefore I expect that student postsecondary choice-sets are more relevant in explaining inequality between suburban and rural students than they are in explaining inequality between suburban and city students, due to more ready access to postsecondary institutions in both cities and rural areas.

### 4.1.2 Racial Inequality and Economic Inequality

Nationally, urban, suburban, and rural communities have different racial make-ups. On average, cities are 44 percent White, 27 percent Hispanic, and 17 percent Black, while suburbs are 68 percent White and rural areas 79 percent White (Parker, 2018). In Michigan, the geography is even more racialized, with cities that are predominantly Black and rural areas are predominantly White. Compared to the racial composition nationally, Michigan has a smaller Hispanic and Asian American population. Due to the highly racialized geography in Michigan, it is possible that any differences observed across place are driven by differences in the racial compositions of these places and racial inequality in postsecondary attainment.

Despite high college aspirations, Black students are less likely to attend four-year colleges than their White peers (e.g. Holland, 2010; Perna, 2000). Some qualitative evidence among Black high school students finds that college aspirants received support and encouragement from their networks; however, their networks remained relatively closed with limited access to comprehensive information for college planning, or for "serendipitous" college learning opportunities (Holland, 2010). Further, legacies of racial segregation and unequal resource allocations in schools, communities, and labor markets have led to the greater concentration of Black students and families at the bottom of the socioeconomic distribution and in under resourced schools that provide lower

academic preparation. In fact, controlling for socioeconomic status and academic preparation, research has found that Black students have a net-advantage in college enrollment and completion (Bennett and Xie, 2003; Michelmore and Rich, 2022). Bennett and Xie (2003) suggest this net advantage may be due, in part, to discrimination and inequality in the labor market. Black individuals face fewer labor market opportunities relative to their White peers with similar credentials, and therefore may need more education to achieve similar employment stability (e.g. Pager, 2003). Given these well documented racial inequalities, I hypothesize that differences in race account for a large portion of the differences between urban and suburban students but is less important in the differences between rural and suburban students. I also expect that accounting for economic disadvantage and academic preparation, we may see city students have a relative advantage in college going relative to rural students (e.g. Michelmore and Rich, 2022).

In addition to racial inequality, economic inequality in college attainment is persistent and growing (Bailey and Dynarski, 2011; Pfeffer, 2018). We know less about how economic inequality in attainment varies geographically. Students from families with low incomes face many barriers to attending college, including the financial constraints of both college and the other upfront costs such as fees, books, and moving expenses (Cox, 2016), the administrative burden of applying for financial aid (Dynarski and Scott-Clayton, 2013), and pressures related to supporting household finances (Cox, 2016), and challenges navigating elite spaces at selective institutions further away from home (e.g. Jack, 2019; Goldrick-Rab, 2016).

If urban areas in Michigan have greater concentrations of students from families with low incomes, this may be driving differences in educational attainment. Students from families with low incomes also often face more non-financial constraints than their peers from families with more financial resources, including caregiving responsibilities, that increase the pressure to remain close to home (Morton, 2019). This may make education deserts a larger barrier for students from low-income families, driving lower attainment in rural areas compared to both urban and suburban areas and may contribute to greater income inequality within rural place. Areas with higher concentrations of students from families with lower socioeconomic status are more likely to be

postsecondary education deserts. Further, communities with lower bachelor's degree attainment rates are less likely to have access to four-year schools (Hillman, 2016). This evidence supports the hypothesis that income may be more consequential for college access and college choices in rural areas, due to greater distance to college combined with a greater need to stay home than their higher income peers.

### 4.1.3 School and Community Composition

The high school students attend, and the high school's college attendance rate, influences both how broadly a student searches for college options, as well as the likelihood a student applies and enrolls in college (Roderick et al., 2011). Resource constraints at high schools with concentrations of the most disadvantaged students, in the form of high school class offerings and counseling support, negatively affect the information that students have about college (Holland, 2010; Radford, 2013). Based on the literature, I expect that peer academic achievement can account for a substantial portion of the attainment gap between students in cities and their suburban and rural peers (e.g. Michelmore and Rich, 2022); however, in rural areas, the constrained choice-sets may limit school advising as well as student exposure to peers with a variety college experiences.

Neighborhood income segregation creates inequalities in the economic and social resources of communities and the schools that serve them. Students' academic achievement is negatively impacted by exposure to neighborhood disadvantage, and longer durations of neighborhood disadvantage result in even worse educational outcomes (Sharkey and Faber, 2014; Wodtke et al., 2016, 2011). Cities in the United States are often characterized as having higher and more persistent concentrated disadvantage, with fewer economic and social resources than students in better resourced suburban communities. We may expect community effects to explain a substantial amount of inequality in educational attainment for urban students relative to rural and suburban students due to the concentrated disadvantage and economic segregation experienced by students in cities. However, suburban and rural poverty rates have been changing over time, leading to higher concentrations of poverty in rural and suburban spaces than ever before (Lichter et al., 2015; Lichter

and Ziliak, 2017). Further, in rural areas, despite higher senses of community and tighter social networks, students receive less parental involvement and lower college going expectations, as well as lower community attainment rates (Byun et al., 2012). Urban communities in the U.S. have nearly twice the proportion of bachelor's degrees than those in rural communities, and rural areas have a greater proportion of individuals with just a high school degree (Parker, 2018). Lower levels of community educational attainment may contribute to decreased individual educational attainment for rural students.

In this section, I identified several key mechanisms that may be driving differences in educational attainment by geography, and hypothesized the ways these factors may create different barriers for students in rural, urban, or suburban areas. In the remaining sections, I document inequality across these dimensions and the ways each factor contributes to educational attainment gaps by urbanicity.

## 4.2 Data and Analysis

I use student-level longitudinal administrative data for the full population of Michigan public school students collected by the Michigan Department of Education and the Center for Educational Performance and Information (CEPI), containing detailed individual records on students from elementary school to high school. Michigan is an interesting case given its sizable rural and urban populations, the presence of both automotive and agricultural industries, and its political context. Further, while Michigan has a mixed history of policy efforts that exacerbate, as well as reduce, existing educational inequalities, the current state's policy context suggests a willingness to understand and remedy inequality. The state of Michigan, as well as its public institutions, have recently enacted policies aimed at reducing inequality in access to higher education[2]; therefore, better understanding of the varying contributions to geographic inequality in college attainment has the

[2]For example, in Governor Whitmer's first state-of-the-state address in 2019, she announced Michigan's "Sixty by 30" goal of increasing the proportion of Michigan residence with a postsecondary credential to 60 percent by 2030. In the years since, the state of Michigan has rolled out several investments in increasing postsecondary attainment, including most recently the "Michigan Achievement Scholarship" (Conroy, 2022; Governor Gretchen Whitmer, 2019).

potential to impact the construction of state and local policy. Urban-rural variation in Michigan is highly racialized: cities are predominantly Black, rural areas are predominantly White. Michigan's low-income populations are spread across cities, suburbs, and rural areas of the state providing an interesting context by which to study the relative contributions of race, economic circumstances, as well as school and community contributions to inequality in college attainment.

I use a four-cohort panel including the full population of 9th grade students who started high school in 2007-2010 (expected to graduate high school between 2010 and 2013) in Michigan public high schools as reported in the state's longitudinal data system. I use 9th grade cohorts to observe differences in academic preparation that would be missed if I drop students who do not complete high school.[3] Using these years provides a large enough population of students with which to explore heterogenous college going rates and allows me to observe up to six-year college graduation. Urbanicity is calculated at the school-level and is time-varying, meaning each student is assigned an urbanicity based on their school and year they were in 9th grade. Urbanicity is from the Common Core of Data (CCD), provided by the Michigan Department of Education, and is measured at the school-level. I collapse this variable into three categories: city, suburb, town or rural. Students missing urbanicity, less than 1 percent of the student population, are dropped. I link census block-group characteristics from the American Community Survey to approximate students' community composition.[4] Table 4.1 provides a detailed description of the variables used in this analysis to measure demographic and academic characteristics, school and community characteristics, and students' postsecondary education choice-sets.

The primary outcomes of interest in this analysis are postsecondary enrollment and completion. I link the K-12 student records to student records from National Student Clearinghouse which details college attendance and completion, Integrated Postsecondary Education Data System (IPEDS) for institutional characteristics, and the Barron's Competitiveness Index data to indicate the selec-

[3]However, Appendix C includes results for high school graduates only, which allows me to compare these Michigan estimates with national estimates of college attendance.

[4]I use the word community here instead of neighborhood given the different meaning of neighborhood in an urban versus rural context. While a census block group, neighborhood, and community may mean all the same things in a city, neighborhood may be less appropriate in rural areas. The goal with this analysis is to approximate the community the student is a part of, whether they consider that community to be a neighborhood or not.

tivity of the college attended. First, I measure enrollment in the fall following expected high school graduation (measured as four years after the 9th grade fall).[5] I also measure where a student enrolls, to account for selectivity of college enrollment. To illustrate this point, I focus on a combined measure of highly and most competitive (the two highest selectivity categories reported in the Barron's Competitiveness Index). Finally, bachelor's degree completion is measured at spring of the sixth year following expected high school graduation, which aligns with the average time elapsed between start and end of a bachelor's degree in the United States (Shapiro et al., 2016).

Each cohort of 9th graders has an average of approximately 138,000 students. Any student who is missing the indicator of urbanicity is dropped from sample (less than 1 percent of the student population). This leaves a full sample of 548,687 individual student observations. For the regression analysis that follows the descriptive results, I use only students who have non-missing data across all the variables. The two main variables missing data are 8th grade math scores, the measure of economic disadvantage, and census characteristics, both of which rely on pre-high-school observations. The final regression sample includes 440,706 students across the four-year period.

I aim to evaluate two sets of empirical questions. First, is there variation by urbanicity in college attainment, type, and completion? How does this vary across individual, school, and community characteristics? Second, do differences in student, school, and community characteristics explain differences in educational attainment?

[5]High school graduation rates differ substantially by place. Seventy-six percent of students from 9th grade cohorts in Michigan rural areas ever graduated from a Michigan public high school, compared with 75 percent of those from suburban areas and 62 percent of students from cities (authors calculations using Michigan's Center for Educational Performance and Information (2023b)). This aligns with national estimates for graduate rates for 12th graders around the same time period, with rural students over 13 percentage-points more likely to graduate from high school (U.S. Department of Education, National Center for Education Statistics, 2014). Appendix C shows results for high school graduates only.

## 4.3 Results

Table 4.2 describes the characteristics of the student population, separately by urbanicity. Rural areas in Michigan are 90 percent White, compared to only 40 percent in cities and 75 percent in suburbs. Rural areas are only 3 percent Black and 3 percent Hispanic, compared with 50 percent and 8 percent for cities and 19 percent and 4 percent for suburbs. There is more persistent economic disadvantage in cities, 47 percent of students were persistently flagged as experiencing economic disadvantage compared to 27 percent in rural areas and 25 percent in the suburbs. Similar patterns exist for school-level economic disadvantage. The average school size in rural areas is much smaller than those in cities or suburbs. Rural and city communities have similar bachelor's degree rates, both about 8 percentage-points lower than suburban communities. The median household income in city communities is lowest, followed by rural communities, and more homes are owner occupied in rural and suburban communities.

Looking at college choice-sets reveals differences in students' access to postsecondary choices. The median distance to the nearest higher education institution for students who live in rural areas is 12 miles, compared with 5 and 3 miles for suburban and city students respectively. Gaps in access to public four-year institutions are even greater. The median distance to the nearest four-year public school for rural students is 24 miles, compared with 8 and 11 for city and suburban students, respectively. Students in rural areas also have fewer options nearby than do city and suburban students. These patterns raise important questions about which factors matter more for student postsecondary attainment.

Finally, this table reports postsecondary outcomes for students including overall college enrollment, four-year and highly-competitive four-year enrollments, and bachelor's degree completion.[6] Figure 4.1 shows the same results visually. Students in suburbs have higher postsecondary attainment rates across all outcomes, followed by students in rural areas, and then by students in cities. Thirty-five percent of students in suburbs enroll at a four-year institution, relative to 32 percent and

[6]College enrollment is measured in the fall immediately following expected high school graduation. When I allow for a gap year, measuring enrollment two falls following expected high school graduation, the enrollment rates patterns are consistent, though higher across the board.

26 percent for students in rural areas and cities, respectively. For highly competitive institutions, the enrollment rates are 4 percent, 3 percent, and 4 percent of suburban, rural, and city students respectively. Finally, for bachelor's degree attainment, 26 percent, 22 percent, and 17 percent of students in suburbs, rural areas, and cities.

The postsecondary education outcomes reported here differ from those that are typically reported for the United States as a whole. These rates are lower, in part because the population used here starts in 9th grade and therefore are not comparable with most national estimates start with high school graduates. Students who do not graduate from high school have a substantially lower college enrollment rate, especially when measured immediately following expected high school graduation.[7]

### 4.3.1 Spatial Distribution of Students and their Postsecondary Choices

Figure 4.2 provides perspective on the locations of rural, suburban, and urban areas across Michigan and where public high school students live. The map on the left shows the Michigan's urban, suburban, and rural classified areas: the darkest areas are cities, and lightest color represent rural areas. The map on the right shows county-level counts of Michigan public school students in 9th grade cohorts from 2007-2010. Comparing these figures shows that the population counts mirror the general definitions of urbanicity, with the highest populations around Detroit, in Wayne County, Flint, in Genesee County, and Grand Rapids, in Kent County. Overlaid on this map are the locations of all degree-granting colleges and universities in the state of Michigan. These institutions are more sparsely located in northern Michigan, which is largely rural, and more densely concentrated in southeast Michigan.

Figure 4.3 overlays the locations of all degree-granting colleges and universities in Michigan over county-level college enrollment and completion rates. Panel A plots two- and four-year public

[7]Limiting to just high school graduates, 44 percent, 39 percent, and 38 percent of students in suburbs, rural areas, and cities enroll in four-year institutions. These results are reported in Appendix Figure C.1. This is more comparable to national estimates, where 42 percent, 40 percent, and 39 percent of students in suburbs, rural areas, and cities attend 4-year colleges (U.S. Department of Education, National Center for Education Statistics, 2014).

colleges and universities over the county-level rates of college attendance. The county-level college attendance rates range from 23 percent to 66 percent, with an average of 50 percent. Panel B shows four-year college attendance rates, with the locations of four-year institutions. Panel C shows highly competitive college attendance, with the locations of the three highly competitive institutions in the state, and Panel D shows county-level rates of bachelor's degree completion with the locations four-year institutions. County-level rates of four-year college attendance range from 9 percent to 58 percent, highly competitive attendance from 0-14 percent, and bachelor's degree completion from 12-37 percent.

These maps display large variations in college attendance and completion by student's 9th grade county. College attendance rates are highest in the darkest counties (where the largest cities are located), such as Washtenaw, Oakland, Huron, and Marquette Counties. Marquette county, in the rural Upper Peninsula of Michigan, is the home of Northern Michigan University. Northern Michigan is a public four-year institution that enrolls five to ten thousand undergraduate students and admits around 70 percent of applicants (U.S. Department of Education's National Center for Education Statistics, 2023). Across Michigan, highly competitive college attendance is quite rare, except for in Washtenaw and Oakland counties. The University of Michigan is the only highly competitive public institution in the state of Michigan and is located in Washtenaw County, in Southeast Michigan, and the two private highly competitive institutions are also located in the southern portion of the state.

The northern lower peninsula is home to very few public institutions. This is especially true for four-year colleges. For example, for students living in Charlevoix County, the median distance to the nearest two- or four-year institution is 15.5 miles. For most students in the county, this is North Central Michigan College, a two-year school in Petosky, Michigan. The median distance to the nearest four-year is 95 miles away. For most students in the county, that is Lake Superior State University, a four-year school in Sault St. Marie, Michigan, over the Mackinaw Bridge in the Upper Peninsula. We see from the maps that students in the upper peninsula do seem to have more access to postsecondary institutions than their peers in the upper lower peninsula.

This is certainly true for two-year institutions. For example, for students who live in Gogebic County, the median distance to a public institution is only 5 miles (Gogebic Community College); however, the median distance to a Michigan public four-year college is 87 miles. By comparison, the students who live in Oakland County, in southeast Michigan, have a median distance to the nearest public college or university of 6.5 miles and 10.5 miles to the nearest public four-year. Oakland County has both public two- and four-year institutions and access to several public four-year institutions in neighboring Wayne and Washtenaw Counties. These maps illustrate unequal access to postsecondary education across the state.

### 4.3.2 Heterogeneity in College Attendance and Completion

Figure 4.4 compares the average rates of college attendance, highly competitive college attendance, and bachelor's degree completion for rural areas, suburbs, and cities, and then the same comparisons across several student characteristics. Overall, rural students are 4 percentage-points less likely to attend college than their suburban peers (but 5 percentage-points more likely than their peers in city schools), and are 1 percentage-point less likely to attend a highly competitive institution than their suburban and city peers. Further, rural students are 4 percentage-points less likely than their suburban peers to complete a bachelor's degree (but 4 percentage-points more likely than their peers in cities). Further analysis shows these patterns are not the same when looking within subgroups.

Panel A focuses on student enrollment at a four-year institution in the first fall following expected high school graduation. Overall, 36 percent of students in suburban high schools enroll in four-year institutions compared with 33 percent of students in rural high schools and 28 percent of students in city high schools. While there are many interesting patterns in this relationship between urbanicity and college going across student characteristics, two in particular stand out: among students in the top quartile of 8th grade math achievement, rural students are 5 percentage-points less likely to attend a four-year college than their suburban peers and 4 percentage-points less likely to attend a four-year college than their peers in city schools. Similarly, while students who are persis-

tently flagged as facing economic disadvantage are similarly disadvantaged in college attendance across urbanicities, rural students who are never flagged as facing economic disadvantage are disadvantaged relative to both their city and suburban peers. The story is less consistent in terms of race. While White and Asian American rural students are disadvantaged relative to their suburban and city pears; Black students from rural areas and cities are similarly disadvantaged relative to their suburban peers. This runs contrast to some intuition that barriers to college attendance and completion may be greatest for rural students who were relatively disadvantaged. The opposite is true: those most disadvantaged on economic, academic, and racial dimensions have similar rates across geographies. The greatest variation comes from those traditionally more likely to attend college: White students, students from more resourced families, and students with higher levels of academic preparation.

These patterns are even more stark when considering highly competitive college enrollment and college completion. Among students in the top quartile of academic achievement, 18 percent of students from city schools attend a highly competitive institution, compared to only 13 percent in suburban schools and 9 percent in rural schools. Among those never flagged as facing economic disadvantage, 4 percent of students in rural high schools compared with 9 percent in city high schools and 6 percent in suburban high schools attend a highly competitive institution. Black students across urbanicities are equally disadvantaged when it comes to highly competitive college attendance. Among White and Asian American students, who are more likely than their racially minoritized peers to attend highly competitive colleges overall, rural students attend highly competitive institutions at lower rates than their city or suburban peers. The gaps follow a similar pattern, but are larger, for six-year bachelor's degree completion.

Both rural and city high school students are less likely to attend college and graduate than their suburban peers; however, the patterns by student characteristics demonstrate that educational inequality is not consistent across place; that is, there are different mechanisms driving the lower likelihood of college attendance in rural areas compared to cities. For example, students who are facing economic disadvantage have similar college attendance rates across place; however, more

economically advantaged students in rural areas lag behind both their suburban and urban peers. This suggests there is something specific about the composition of rural areas driving these lower college attendance and completion for more advantaged students.

That rural students are five percentage-points more likely to attend college than their peers in cities is counter to many of the national averages reported in past studies. There may be several factors that likely contribute to this. One may question whether the city of Detroit, given Michigan's historical policy driven racial segregation, underfunding of schools, and concentrated poverty is driving the results for city students. Appendix Table C.3 provides greater detail on the schools in the city of Detroit compared with schools in other cities. At a high level, a higher proportion of those students who attend schools in Detroit, compared with other cities, are Black, in the bottom quartile of 8th grade test scores, experience more persistent economic disadvantage, and have lower postsecondary attainment than students in suburbs, rural areas, or other cities. However, Appendix Figure C.3 shows that even excluding schools in the city of Detroit, students in cities attend college at lower rates than their rural and suburban peers and complete bachelor's degrees at similar rates to their rural peers.

Beyond the city of Detroit, an additional factor is that students in cities are much less likely than students in rural areas to graduate from high school.[8] Most national estimates for college going, and those reported in past studies of geographic differences, focus on high school graduates. Appendix Figure C.2 reports college going rates for high school graduates only, and these results more closely align with national estimates of geographic differences, with students in cities and rural areas starting and completing four-year college degrees at similar rates, both lower than students in suburbs. Specifically, 69 percent of suburban high school graduates, 63 percent of urban and rural high school graduates attend any college. Estimates for four-year college attainment align closely with those reported by NCES for the United States as a whole, with 42 percent of

[8]Seventy-six percent of students from 9th grade cohorts in Michigan rural areas ever graduated from a Michigan public high school, compared with 75 percent of those from suburban areas and 62 percent of students from cities (authors calculations using Michigan's Center for Educational Performance and Information (2023b)). This aligns with national estimates for graduate rates for 12th graders around the same time period, with rural students over 13 percentage-points more likely to graduate from high school (U.S. Department of Education, National Center for Education Statistics, 2014).

suburban high school graduates, 40 percent of rural high school graduates, and 39 percent of city high school graduates attending four-year institutions. Patterns of heterogeneity by student characteristics are similar to those reported for 9th grade cohorts. However, using 9th grade cohorts highlights important differences in academic preparation by urbanicity that may be contributing to variation in college attendance which are masked when looking at high school graduates. This is important to note because college interventions can only go so far in reducing inequality in college attendance and completion if inequality in academic preparation is not addressed simultaneously.

This section described the heterogeneity that exists within student characteristics, across rural, urban, and suburban places. In the next section, I use a regression exercise to investigate whether and how observable differences between rural, suburban, and urban communities can account for the overall gaps in college enrollment, college selectivity, and bachelor's degree completion.

### 4.3.3 What Can Account for Geographic Inequality in College Attainment

Table 4.3 reports results from a regression of each postsecondary outcome (four-year college enrollment, highly competitive college enrollment, bachelor's degree completion) on an indicator for urbanicity (suburb, city, rural) with suburb left out as the comparison group. By controlling for each of these different factors, we are able to observe whether observable differences in the composition of urban, rural, and suburban places can account for college attainment gaps.

The first row reports the unadjusted coefficients from a regression with no additional controls (the unadjusted city-suburb, rural-suburb, and rural-city gaps). The remaining rows sequentially add the various control variables to note how each addition changes the coefficient representing the geographic gaps. Starting with four-year college attendance, students in cities are 9 percentage-points less likely to attend than their suburban peers. Rural students are 3 percentage-points less likely than their suburban peers and 6 percentage-points more likely than their city peers to attend a four-year school. The rows below sequentially add control variables to observe the changes in the urbanicity gaps in four-year college attendance.

First, controlling for race does substantially reduce the gap between city and suburban students,

and eliminates the gap between rural and city students. Controlling for economic circumstances in addition to race brings the city-suburb gap to zero and reverses the rural-city gap, with rural students now 2 percentage-points less likely to enroll in a four-year school than their urban peers. That is, the higher concentrations of students who are persistently flagged as economically disadvantaged as well as a higher concentration of Black and Hispanic students, can more than account for the lower four-year college attendance for city students. Accounting for school composition (which includes the school's economic composition, the size of the high school cohort, and the high school dropout rate) does further change the city-suburb difference, actually reversing the coefficient resulting in a 2 percentage-point advantage for city students in four-year college attendance relative to their suburban peers. While accounting for school composition did to reduce the rural disadvantage, accounting for community composition (which includes percent of adults with a bachelor's degree, unemployment rate, median household income, and percentage of housing units that are owner occupied) does close the remaining gap between city-rural students and reverses the rural-suburb difference. As we saw in Table 4.2, rural students live in communities with lower bachelor's degree attainment and lower median household income than their suburban peers. Community bachelor's degree attainment rates are positively associated with college attendance and completion, and we observe here that these lower rates in rural areas do account for some of the rural collage attainment deficit.

To simplify this analysis, the bottom two rows focus on just two parts of this analysis: school composition and community composition, eliminating the other covariates from the regression model. Here, we see that school composition alone more than accounts for the city-suburb gap in four-year college attendance, as well as the city-rural gap. Whereas community composition alone accounts for much of, but not all, the city-suburb gap in four-year college attendance. Community composition more than accounts for rural disadvantage relative to suburban and city students in four-year college attendance. Of particular note is that the contribution of school composition to the city-suburb gap roughly mirrors the contribution of community composition to the rural-suburb gap. That is, without accounting for other characteristics, school and community compositions are

similarly weighted in contributing to these respective gaps.

In the next set of columns, I conduct the same exercise for highly competitive college attendance. High school students in cities are half a percentage-point less likely to attend highly competitive colleges than their suburban peers, and the controls added more than make up for that small gap. High school students in rural areas are 1-1.5 percentage-points less likely than their peers in suburban areas and cities to attend a highly competitive college. Controlling for postsecondary choice-sets makes up for the gap between rural and suburban students and reduces the gap between rural and city students but does not erase it entirely. The patterns for bachelor's degree attainment are quite similar to four-year college attendance, particularly for city students when compared with suburban students.

The pattern for rural students relative to suburban and city peers are similar as well; however, in this case, the addition of this set of control variables does not fully make up for the gap. Compared with their peers in cities, rural students are still nearly 2 percentage-points less likely to attain a bachelor's degree, even when controlling for the suite of demographic, student, school, and community characteristics. However, for bachelor's degree attainment, like four-year attendance, controlling for only school characteristics more than makes up for the city-suburb gap, whereas, controlling for only community characteristics more than makes up for the rural-suburb gap. The key finding from this analysis: in most instances, gaps in four-year college attendance are more than accounted for by their composition of student, school, and community characteristics. However, different factors appear to contribute more to attainment gaps driven by rural attainment versus city attainment. Put a different way, controlling for student characteristics, their postsecondary choice-set, and their school and community composition reduces (and in many cases reverses) urbanicity gaps in college attainment.[9] While these results are descriptive rather than causal esimtaes, they still highlight factors and barriers in each type of place that should be considered in the development of policy.

[9]A formal Oaxaca-Blinder decomposition shows similar results: rural-suburb and city-suburb gaps in postsecondary attainment are largely explained by differences in composition. Decomposition results available in Appendix Table C.4.

## 4.4 Discussion and Conclusion

In this paper, I have shown the geographic variation in overall four-year college attendance, highly competitive college attendance, and six-year bachelor's degree completion rates in Michigan. The analysis has highlighted that simply looking at overall city-rural-suburban differences in college attainment overall is insufficient for understanding existing geographic inequality. There is important geographic heterogeneity in postsecondary outcomes by student academic preparation, race, and economic circumstances. That is, among students with different levels of academic preparation, there is greater variation in geographic inequality. Finally, through a simple descriptive regression exercise I have documented that the geographic gaps in postsecondary attainment can be explained by differences in the compositions of these places: economic disadvantage, race, neighborhood, and school composition.

Given the racialized geography of the state of Michigan, I anticipated that differences in racial composition between cities, rural areas, and suburbs could be driving all the geographic differences in college attainment. In particular, the racial demographics of Michigan differ from the racial composition of the United States. While rural areas in the United States are 79 percent White, 8 percent Black, and 8 percent Hispanic (Parker, 2018), in Michigan 90 percent of rural high school students are White (Author's calculations using data from Michigan's Center for Educational Information and Performance Michigan's Center for Educational Performance and Information, 2023b). I do find that race does account for some of the city-suburb and city-rural gaps. However, when controlling for other student and school characteristics, we actually see a reversal of the city-suburb and city-rural gaps, aligning with the literature finding that Black students are more likely to go to college than White peers after controlling for economic circumstances, academic preparation, and school (Bennett and Xie, 2003; Michelmore and Rich, 2022). Among racial groups, interesting heterogeneity emerged that has been relatively unexplored in the literature. Racial gaps in attainment are slightly smaller in rural areas than in suburban or city areas; however, this is driven by lower attendance and completion among White rural students, rather than improved outcomes among Black rural students. Black students are similarly disadvantaged in college attendance and

completion regardless of their geographic context.

While race is certainly a contributing factor, this analysis revealed that it is not the only contribution to inequality by geography. Graphically, the results show that access to postsecondary institutions varies greatly across geography in ways that visually correspond to the rates of college going by county. Geographic disparities in college attendance and completion, particularly when comparing rural-suburb differences, are descriptively largest for those from relatively advantaged groups: students never flagged as economically disadvantaged, students in the top quartile of math achievement, as well as White and Asian American students.

The students in rural areas that seem to be driving any college enrollment and completion deficits are higher income, higher achieving, and White students. It is possible this can be explained by findings by Klasik et al. (2018), who find that students who live in complete education deserts (that is, have no open access colleges nearby) are more likely to travel further away for college; however, students who live in match deserts (that is, have no postsecondary options that match their academic credentials) are less likely to attend an institution that matches their academic qualifications. As is evident from the maps of postsecondary institutions, while many students have access to two-year schools nearby, many students have to travel quite far to attend a four-year institution (and even further, more selective institutions where they are more likely to persist and graduate). Among those students who are most likely to attend college, I find that rural high school students are less likely than their peers to attend a four-year or more selective institution and complete a bachelor's degree.

These results make sense in the context of the literature that suggests that students in smaller schools that are more geographically isolated are less likely to attend institutions that match their academic credentials and suggest that policies should not rely on finding high achieving students in concentrated geographies but must reach them where they are (Hoxby and Avery, 2012), in this case, in rural communities. This further helps explain why the HAIL Scholarship in Michigan was much more effective in rural areas in the state of Michigan (Dynarski et al., 2021). This scholarship intervention is targeted at high achieving students from families with low incomes and is particu-

larly effective for rural students relative to their suburban and especially their urban peers. Here, I find that descriptively, the largest rural-suburb gaps exist for students at the top of the academic achievement distribution, and that rural-suburb gaps and rural-city gaps exist for highly selective college attainment. Students' postsecondary choice-sets as well as their community compositions more than account for the highly competitive college attendance gap between rural and suburban students; therefore, these same factors may explain why HAIL was so effective in these areas. This is in contrast to the large contribution that academic preparation plays in accounting for the city-suburb deficit. This is further supported by limiting the analysis to only high school graduates in Appendix C, where the city-suburb gap is greatly reduced but the rural-suburb gap remains nearly the same. This supports the idea that policies to reach these students must rely less on higher concentrations of students in schools, or on their geographic proximity to the recruiting schools, and instead seek out talented students where they are as these students are less likely to attend without these types of policy interventions.

There are a few key limitations to this analysis that future studies should build on. First, in some ways the consideration of where students live in relation to postsecondary institutions is relatively naïve. It does not consider community college taxing districts, which allow students to gain in-district tuition at certain community college programs, or local financial aid interventions such as local promise scholarships that may influence the choices students consider. In these ways, future research may want to consider more directly the institutional contexts of students and the ways these may shape college-going in certain places. Second, further work is needed to identify causal mechanisms between students' neighborhood, school, and demographic characteristics and their postsecondary outcomes.

These results are intended only to paint a descriptive picture of the state of college-going across geography, understanding the distribution of college attainment across a large and geographically diverse state such as Michigan. However, this is an important step towards understanding the unique barriers and choices facing students from different geographic contexts. When considered together, these results show that there are many common factors driving inequality across rural,

suburban, and urban places; and there are different factors that contribute to gaps in college attendance across urbanicities. In order to increase college attendance and completion, there is a need to address the sources of these inequalities. In rural areas, this may be considering the role of community in shaping student college going outcomes, as well as the choices that students have available to them for their postsecondary attendance. In cities, the role of unequal schooling options that lead to inequitable academic preparation as well as the impact of economic disadvantage in cities compared to other places need to be considered. Further, in designing equitable policies aimed at improving college attendance and completion rates, close attention should be paid to those that face barriers regardless of where they live. If policy makers are sincere in their interest in addressing inequities, policy needs to be targeted to the unique barriers faced by students in different places. Policy solutions need to be nuanced to address the factors contributing to inequality in order to improve overall effectiveness.

Table 4.1:
Variable Definitions

| Variable | Definition and Construction |
|---|---|
| Race | Indicators provided in 9th grade in the administrative data. Six racial/ethnic categories are included: Black/African American, White, Asian American, Hispanic, Native American, and Native Hawaiian or Alaskan Native or Other Pacific Islander. The last two categories are combined, and are dropped from some analyses (when noted) due to a sample size too small. |
| Sex | Indicators provided in 9th grade in the administrative data for male and female. Unfortunately, more inclusive gender categories are not available in the administrative data. |
| Economic circumstances | As a proxy for student economic circumstances, I use the indicator constructed by CEPI for economic disadvantage (equal to one of a student meets one of the following criteria: eligible for free or reduced-price lunch, receiving Supplemental Nutrition Assistance Program (SNAP), receiving Temporary Assistance to Needy Families (TANF), in foster care, eligible for Migrant Education Program, or classified as homeless). While still not a perfect proxy for economic circumstances, I calculate a more dynamic measure to better approximate the most and least economically disadvantaged (see Michelmore and Dynarski, 2017; Michelmore and Rich, 2022). I identify students who were never, sometimes (1-3 years), and always classified as economically disadvantaged between 7th and 9th grade (never, sometimes, persistently ED). |
| Academic Preparation | I use (standardized) 8th grade test scores. For heterogeneity analyses this is split into quartiles of achievement (quartiles calculated on the full student population). I use 8th grade scores instead of the 11th grade assessment (the ACT during the period of study) because there is large number of students who stop out of high school in school between 10th and 11th grade. |
| Distance to nearest institutions | I calculate the distance (in miles) between the centroid of a student'ss census block (in the 2010 census) to the nearest degree-granting public institution, nearest public 2-year, and nearest public 4-year institution. Appendix D provides context on the census block as a geographic unit. |
| Number of institutions | I calculate the number of degree-granting, number of public, and number of 4-year institutions within a student's commuting zone. Research on education deserts uses measures of institution accessibility within commuting zones to proxy for student postsecondary options (e.g. Hillman 2016; Klasik et al. 2018). Commuting zones are calculated by the U.S. Department of Agriculture and represent a cluster of counties that are intended to proxy for local labor markets, i.e. where people work relative to where they live. |
| School composition | I include characteristics describing the composition of the school including the percent of students receiving free or reduced-price lunch, the dropout rate, and the number of students in their school's 9th grade cohort. |
| Community composition | I include the percent of people in the block-group with a bachelor's degree, the unemployment rate, the median household income, and, to proxy for housing stability, I use percentage of housing units that are owner occupied. |

Table 4.2:
Sample Characteristics: Michigan Public High School 9th Grade Cohorts (2007-2010)

| | Overall | Suburb | City | Town/Rural |
|---|---|---|---|---|
| Student Characteristics | | | | |
| Black | .212 | .193 | .499 | .036 |
| White | .705 | .735 | .38 | .896 |
| Hispanic | .047 | .035 | .079 | .037 |
| Asian American | .023 | .028 | .035 | .009 |
| American Indian or Alaska Native | .011 | .008 | .005 | .018 |
| Native Hawaiian or Pacific Islander | .002 | .002 | .001 | .003 |
| Female | .485 | .488 | .488 | .480 |
| Never ED (7th-9th grade) | .53 | .607 | .337 | .571 |
| Sometimes ED (7th-9th grade) | .158 | .144 | .193 | .150 |
| Persistently ED (7th-9th grade) | .313 | .249 | .47 | .279 |
| 8th Grade Math Score (standardized) | -.007 | .071 | -.244 | .062 |
| College Choice-Set | | | | |
| med distance to nearest institution (miles) | 5.5 | 4.5 | 3.3 | 11.7 |
| med distance to nearest 2-year public (miles) | 9.1 | 7.9 | 5.9 | 16.2 |
| med distance to nearest 4-year public (miles) | 12.8 | 11.0 | 8.2 | 24.0 |
| Avg. Number Degree-Granting Institutions within CZ | 21.3 | 27.6 | 25.9 | 11.5 |
| Avg. Number Public Institutions within CZ | 6.0 | 7.3 | 7.0 | 3.8 |
| Avg. Number Public 4-years within CZ | 2.0 | 2.5 | 2.4 | 1.3 |
| School Characteristics | | | | |
| % Free/Reduced-price lunch eligible | 34.6% | 27.9% | 50.7% | 30.9% |
| Dropout Rate | 8.7% | 8.1% | 13.2% | 6.2% |
| Number of Students (in 9th grade cohort) | 297.9 | 372.9 | 330.2 | 194.4 |
| Block-Group Characteristics | | | | |
| % with at least a BA | 23.9% | 28.7% | 20.7% | 20.9% |
| Unemployment rate | 14.1% | 12.7% | 19.9% | 11.6% |
| Proportion housing units owner occcupied | .664 | .715 | .534 | .699 |
| med HH Income | 54,390.8 | 63,303.2 | 42,933.9 | 52,637.2 |
| Postsecondary Educational Outcomes | | | | |
| College enrollment | .518 | .559 | .446 | .524 |
| 4-year college enrollment | .319 | .350 | .264 | .323 |
| Highly competitive+ college enrollment | .033 | .039 | .037 | .025 |
| Bachelor's degree (within 6 years expected HS graduation) | .223 | .259 | .172 | .219 |
| N Students | 548,687 | 214,819 | 135,909 | 197,959 |
| N Students (with no missing data) | 440,706 | 173,682 | 102,302 | 164,722 |

*Notes:* Population includes 9th grade cohorts 2007-2010. Statistics displayed are means unless otherwise noted. "CZ" refers to the commuting zone of the student's home county (U.S. Department of Agriculture 2023). The total number of students are included in the descriptive statistics. The sample with no missing data is used in the regression analyses.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023); U.S. Census Bureau (2023a).

Table 4.3:
Regression Between Urbanicity and College Attainment Outcomes with Sequential Covariate Additions

| | Panel A. Enroll Four-Year | | | Panel B. Enroll Highly Selective+ | | | Panel C. BA Completion | | |
|---|---|---|---|---|---|---|---|---|---|
| | City Coefficient | Rural Coefficient | Rural - City Coefficient | City Coefficient | Rural Coefficient | Rural - City Coefficient | City Coefficient | Rural Coefficient | Rural - City Coefficient |
| Unadjusted | -0.089 | -0.029 | 0.060 | -0.004 | -0.015 | -0.011 | -0.101 | -0.046 | 0.055 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| + Race | -0.037 | -0.044 | -0.007 | 0.008 | -0.017 | -0.024 | -0.028 | -0.071 | -0.043 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| + Economic Circumstances | 0.002 | -0.016 | -0.017 | 0.014 | -0.012 | -0.026 | 0.008 | -0.045 | -0.053 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| + Gender | 0.001 | -0.015 | -0.017 | 0.014 | -0.012 | -0.026 | 0.008 | -0.045 | -0.052 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| + Academic Preparation | 0.001 | -0.004 | -0.005 | 0.014 | -0.009 | -0.023 | 0.008 | -0.035 | -0.043 |
| | (0.002) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| + Postsecondary Choice-Set | 0.009 | 0.000 | -0.009 | 0.013 | -0.004 | -0.017 | 0.010 | -0.021 | -0.030 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + School Composition | 0.023 | -0.001 | -0.023 | 0.018 | -0.007 | -0.025 | 0.029 | -0.014 | -0.043 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Community Composition | 0.014 | 0.015 | 0.001 | 0.013 | 0.000 | -0.013 | 0.020 | 0.004 | -0.016 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| Just School Composition | 0.039 | -0.001 | -0.039 | 0.028 | -0.012 | -0.040 | 0.036 | -0.011 | -0.047 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| Just Community Composition | -0.008 | 0.033 | 0.041 | 0.015 | 0.006 | -0.009 | -0.011 | 0.016 | 0.027 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| Suburb Mean | [0.362] | | | [0.040] | | | [0.271] | | |
| N | 440706 | | | 440706 | | | 440706 | | |

*Notes:* Results based on sequential linear probability regression models, where the binary postsecondary outcome is regressed on urbanicity indicator variables (suburb left out as a reference category). Population includes 9th grade cohorts from 2007-2010. Covariates are added sequentially, and the coefficients reported are from the urbanicity indicator in each of the sequential models. Only observations without missing data included.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023); U.S. Census Bureau (2023a).

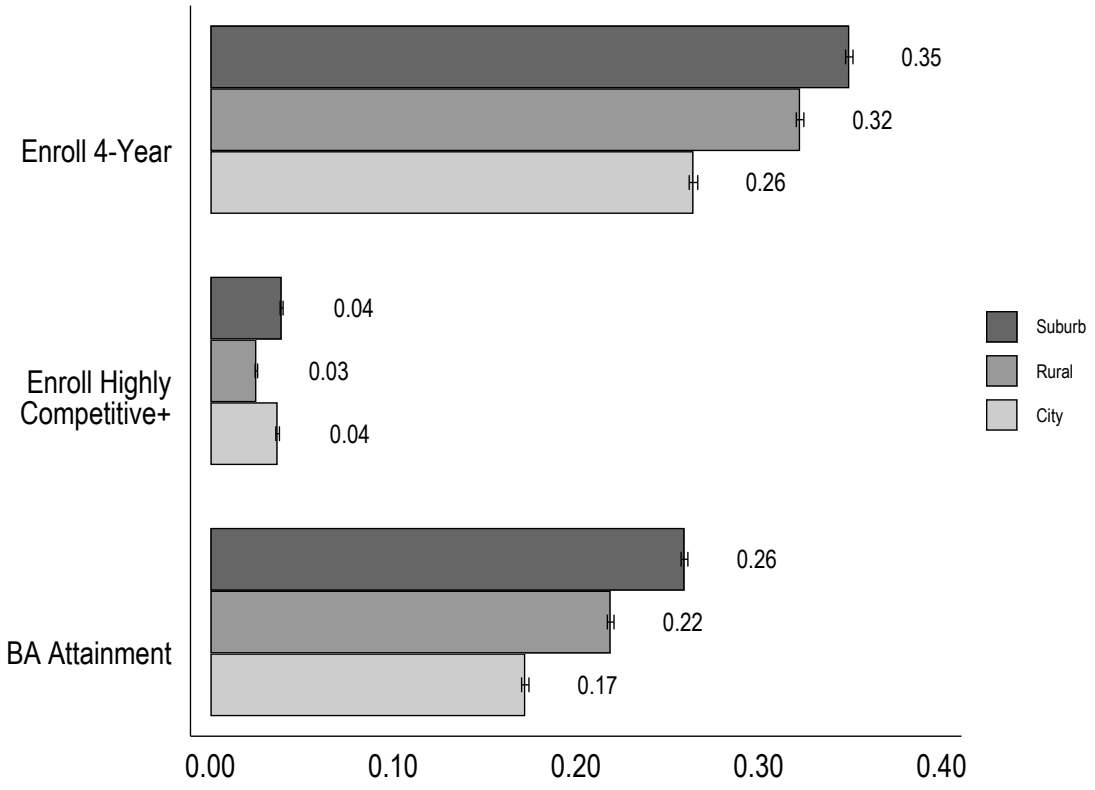



Figure 4.1:
Overall College Enrollment and Completion by Urbanicity

*Notes:* Rates calculated for Michigan public high school 9th grade cohorts between 2007-2010. Enrollment rates calculated in the fall following expected on-time high school graduation. Bachelor's degree attainment is measured in the spring of the 6th year following expected on-time high school graduation.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a).

Panel A. Urbanicity in Michigan

Panel B. Distribution of Michigan Students and Postsecondary Institutions

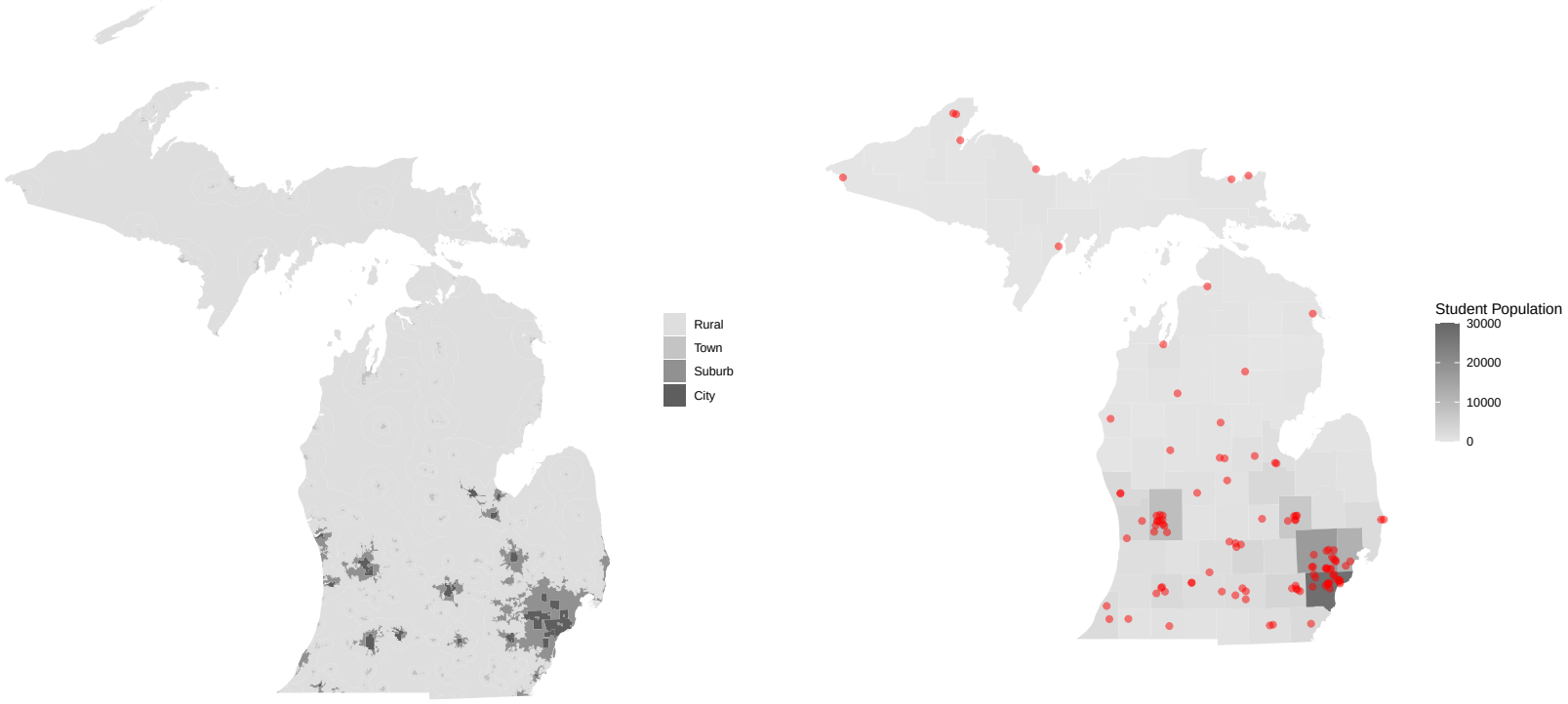
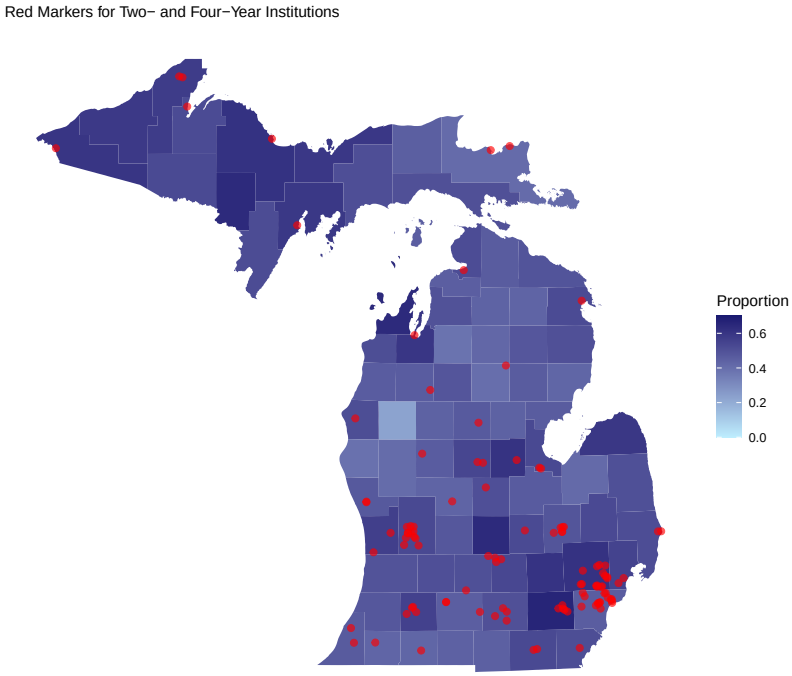



Figure 4.2:
Geographic Distribution of Michigan Students and Postsecondary Institutions

*Notes:* Panel A presents the distribution of urbanicity across the state (U.S. Census Bureau, 2023b). The student population counts at the are calculated as the average number of students per cohort in each county, across 9th grade cohorts 2007-2010 in each county. Institution locations based on latitude and longitudes reported in IPEDS, limited to only undergraduate degree-granting institutions, as reported in IPEDS.
*Source:* U.S. Census Bureau (2023b); Michigan's Center for Educational Performance and Information (2023b); U.S. Department of Education's National Center for Education Statistics (2023).

Panel A. Enrollment at any Degree Granting Institution




Panel B. Enrollment at a Four-Year Institution

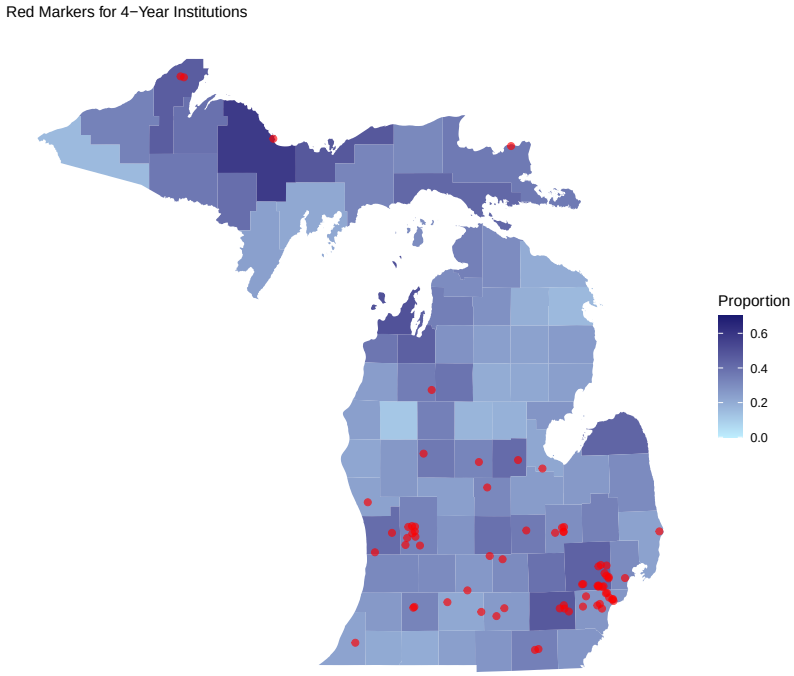
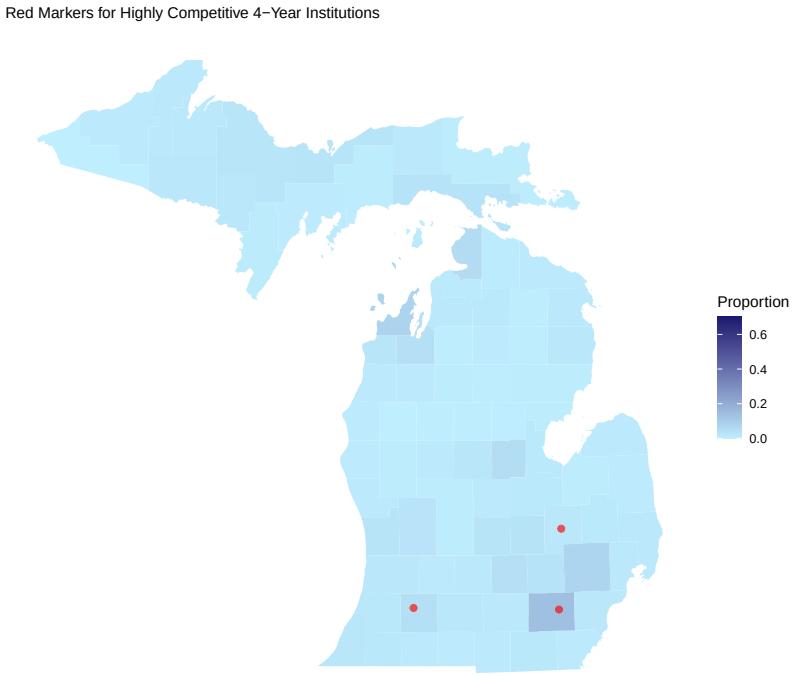



Figure 4.3:
College Enrollment and Completion by County

Panel B. Enrollment at a Highly Competitive+ Institution




Panel D. Six-Year Bachelor's Degree Completion

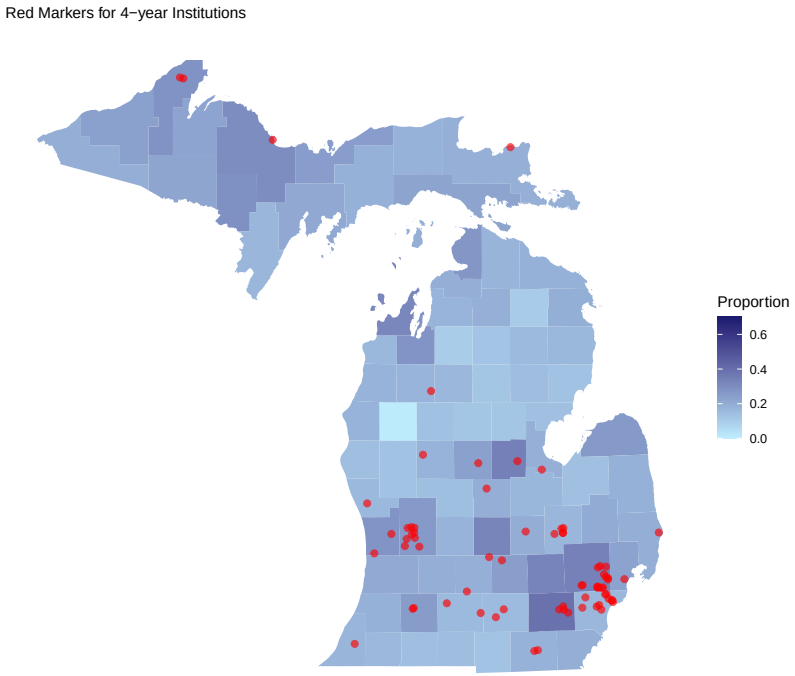



Figure 4.3:
College Enrollment and Completion by County (cont.)

*Notes:* Enrollment rates based on the fall following expected on-time high school graduation, averaged within county across 2007-2010 9th grade cohorts. Bachelor's degree attainment is measured in the spring of the 6th year following expected on-time high school graduation. Institution locations based on latitude and longitudes reported in IPEDS, limited to only undergraduate degree-granting institutions, as reported in IPEDS.
*Source:* U.S. Census Bureau (2023b); Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023)

Panel A. Enrollment at a Four-Year Institution

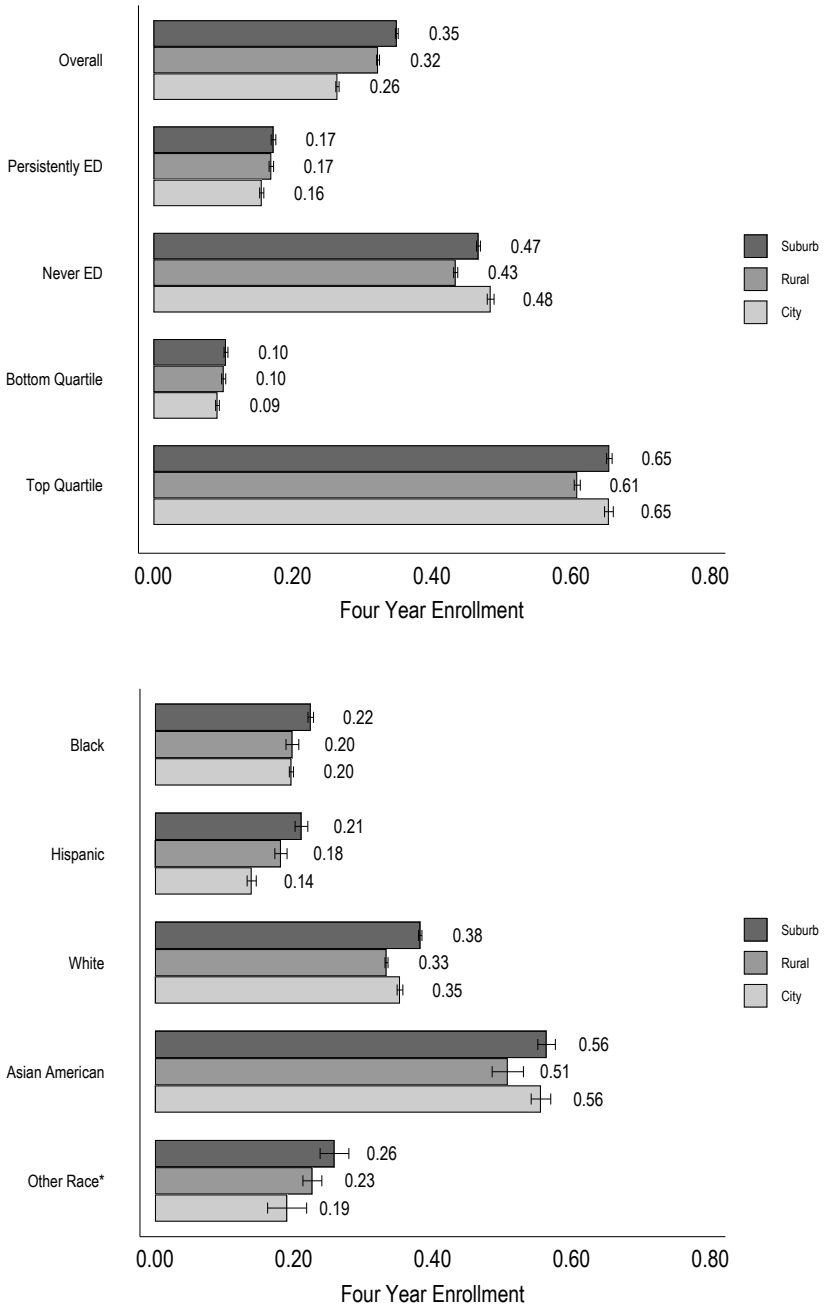



Figure 4.4:
Heterogeneity in College Enrollment and Completion across Urbanicity

Panel B. Enrollment at a Highly Competitive+ Institution

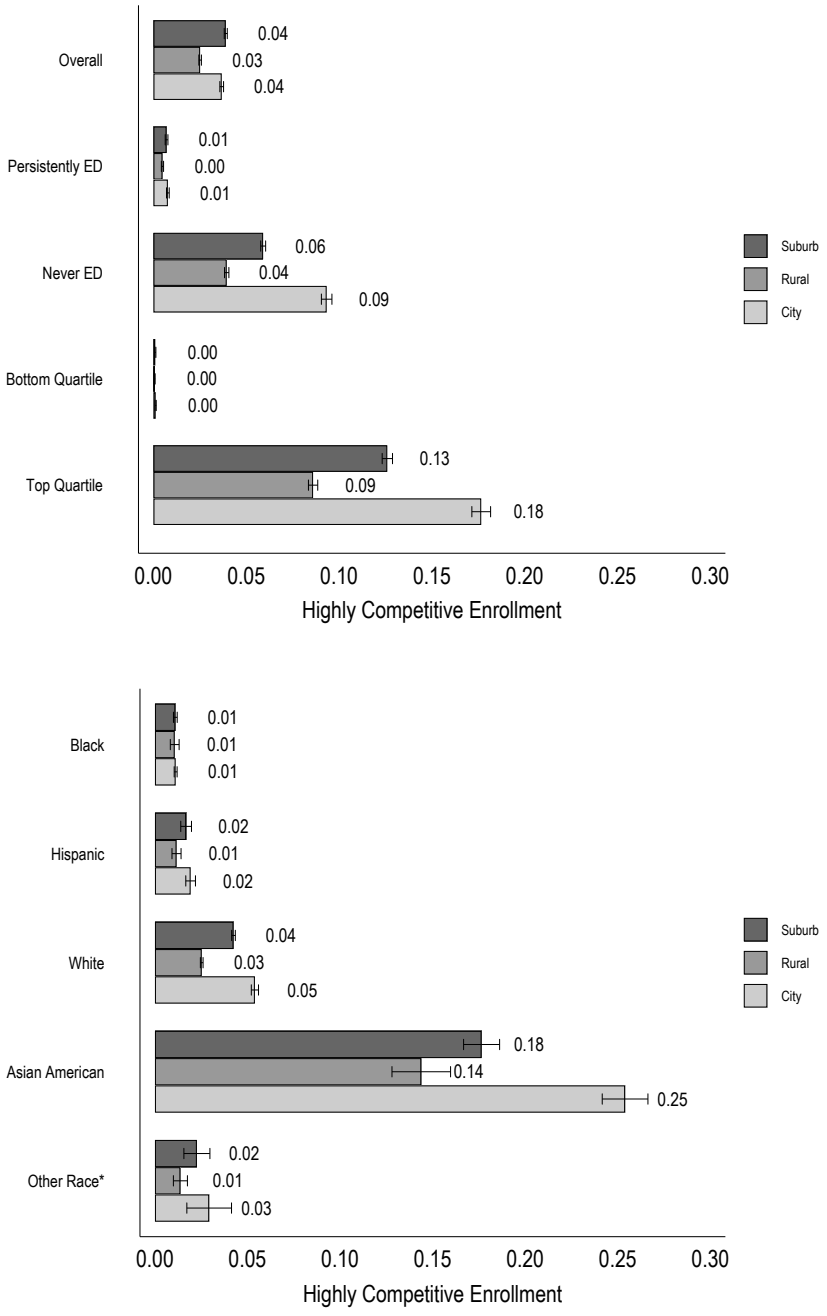



Figure 4.4:
Heterogeneity in College Enrollment and Completion across Urbanicity (cont.)

Panel C. Bachelor's Degree Completion

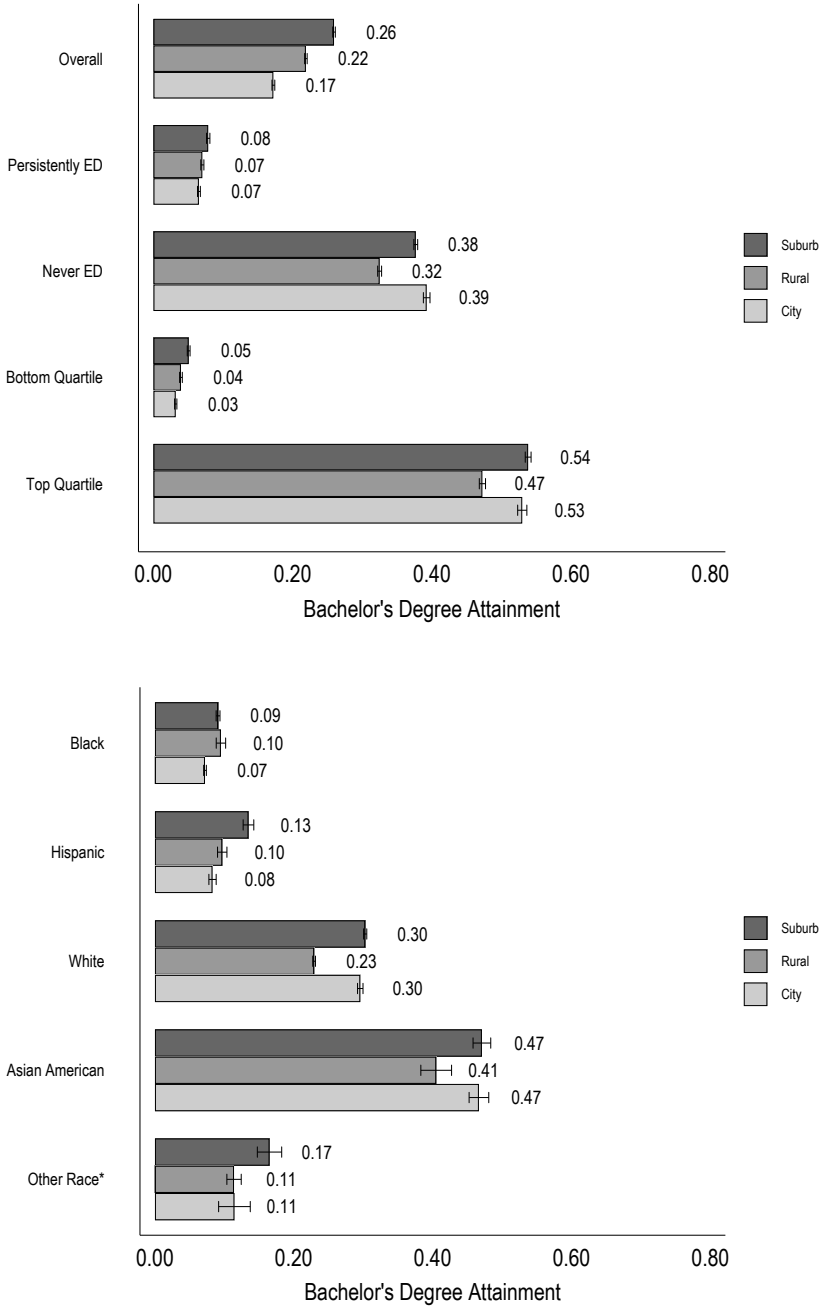



Figure 4.4:
Heterogeneity in College Enrollment and Completion across Urbanicity (cont.)

*Notes:* Rates calculated for Michigan public high school 9th grade cohorts between 2007-2010. Enrollment rates calculated in the fall following expected on-time high school graduation. Bachelor's degree attainment is measured in the spring of the 6th year following expected on-time high school graduation.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a)

# CHAPTER 5

# Conclusion

## 5.1 Summary of Findings

Each empirical chapter draws on different methodological approaches to evaluate three contexts that shape student post-secondary choices. The first draws on experimental variation using a randomized, controlled trial to evaluate how two different "free tuition" policy designs compare in their ability to shape student college enrollment behavior. This study aimed to identify design features that are necessary for removing the barriers faced by students from families with low incomes to selective college attendance, speaking to the broader federal, state, and institutional policy conversation around how to design "free tuition" policies. Like many institutions around the state of Michigan[1] and nationally, the University of Michigan hoped to replace more targeted interventions with their widely advertised *Go Blue Guarantee*.[2] Like policies at other institutions, the *Go Blue Guarantee*, is essentially rebranding and widespread advertising of existing financial aid which requires means testing, and a lot of administrative paperwork on the part of students to qualify.

We designed an intervention to evaluate this type of policy against a previously very successful scholarship intervention, the HAIL Scholarship, an early four-year commitment of free tuition at the University of Michigan. We found that the unconditional guarantee had a much larger effect

[1] Prestininzi (2023) outlines each of these tuition "guarantees" in Michigan, including most recently Wayne State University and Northern Michigan University, which require means testing through the federal financial aid application prior to determining eligibility.

[2] As a reminder, the Go Blue Guarantee promises free tuition to in-state students with income below $65,000 and assets below $50,000, conditional on traditional need-verification processes.

on application and enrollment. An informational treatment that told students about the *Go Blue Guarantee* and their likely eligibility but made no commitments, had no effect on enrollment at all. We concluded that "free tuition" policies that require verification before a promise of aid is made, as most "free tuition" policy designs do, are much less effective in increasing enrollment among students from low-income families than an upfront guarantee.

While experimental evidence is well suited for informing us about whether different policy tools can effectively reduce inequality, qualitative evidence can further enlighten these decision-making processes to tell us more about the social and institutional factors that shape inequality and how policy intervention might work. In the second empirical chapter (chapter 3), I collected qualitative interview data from a stratified random sample of students in the experimental evaluation to speak to these qualitative processes of decision making. I extend the long-standing literature that establishes social capital as a key resource in supporting, or constraining, educational attainment by identifying one understudied resource that students rely on for information and support through their postsecondary transition: older siblings. Using a stratified, random sample of students in the HAIL Scholarship study, I conducted longitudinal qualitative interviews with high school seniors as they made their postsecondary decision and again after they had transitioned. While this study set out to understand student decision making broadly, the research participants made clear the role that older siblings played not just in replicating information from other sources but as a distinct resource that students relied on, in both implicit and explicit ways.

Among other things, older siblings helped students to anticipate what uncertainty and potential pitfalls lay ahead before making final decisions. Younger siblings received support shared by an older sibling regardless of how connected students felt to their siblings' postsecondary experience. This served to simplify the process for the younger sibling and allowed them to achieve their goals with fewer roadblocks. Compared to the other sources of information in a student's life, siblings often provided support on all of the dimensions that makes for a strong resource: the relationship is frequently a long-term, trusting relationship (relationship intensity); siblings often have more recent information (external relevance); and unlike peers or teachers, siblings come from

the same home environment and financial circumstances, making their experiences more likely to be directly applicable to a students' life (internal relevance). While many policies and institutional factors play an important role in increasing college access, awareness of the deep relationships that affect student decision-making is important for understanding patterns of educational attainment. Prior research used siblings to control for family circumstances or identified the effects of parental resource investment; however, siblings are a distinct way that students acquire information that may shape the choices they make. Beyond removing barriers, policies should lean on and understand the resources students use to make their decisions.

The first two empirical chapters focus on the barriers that students from low-income families face in the process of attending college; and focused on the ways policies can be designed to more effectively meet the needs of students from families with less economic and social resources. They helped illuminate mechanisms driving educational decision making; both the necessary and sufficient elements of a successful financial aid policy intervention, and the contribution of students' social resources in supporting the transition to postsecondary education or work. While the HAIL Scholarship study intentionally aimed to reduce well documented economic inequality in selective college attendance, it highlighted an additional source of inequality. The intervention was most effective in rural areas, with relatively lower treatment effects in cities and suburbs (Dynarski et al., 2021). However, we previously knew little about rural-city-suburban inequality in college attainment in Michigan. The third empirical chapter (chapter 4) investigated this source of inequality.

In this chapter, I found that suburban students were most likely to attend a four-year college or university, followed by rural students and then city students. Among higher achieving students, I found a lower four-year college attendance rate (overall and at highly selective institutions) and bachelor's degree completion rates in rural areas relative to cities and suburbs. Extending to the factors contributing to the gap, I found that students' postsecondary choice-sets as well as their community compositions more than accounted for the highly competitive college attendance gap between rural and suburban students. This suggests that these same factors may explain why HAIL was so effective in these areas. This supports the idea that policies to reach these students must

rely less on higher concentrations of students in schools or on their geographic proximity to the recruiting schools and instead seek out talented students where they are, as these students are less likely to attend without these types of policy interventions.

However, the results of this chapter also suggest that media narratives about White, rural students falling behind their urban and suburban peers are not telling a complete story. White, higher-income, and higher-achieving students in rural areas do have lower college-going rates than their peers in urban or suburban places. However, these groups still have significantly higher college attainment than their peers who are racially minoritized, peers from families with low incomes, or peers who are less academically prepared, regardless of where they live. Policies that do not explicitly target the needs of these populations of students, whether they live in cities or rural areas, will have limited effect on continued inequality.

## 5.2 Directions for Future Research

Using this multimethod approach, I was able to explore three distinct questions of educational decision making that require different approaches to answer. The results from each empirical study pose questions for future evaluation and policy consideration. First, policy stakeholders should be wary of the proliferation of free tuition "guarantees" that rely on traditional means-testing processes. Our study adds to the evidence that means-testing and administrative burdens attached to the provision of social programs have been shown to dissuade take-up of social programs, especially for those most in need of their services (Currie, 2006; Finkelstein and Notowidigdo, 2019; Herd and Moynihan, 2019), and that information about financial aid is not enough to overcome the barriers students from families with low incomes face to college enrollment (e.g. Bettinger et al., 2012; Bergman et al., 2019; Hyman, 2020). While we were unable to evaluate the *Go Blue Guarantee* on its own, in descriptive results we found that its implementation had nowhere near the size of the effect that the HAIL implementation had on the number of students from families with low incomes enrolling at the University of Michigan. Further, if the *Go Blue Guarantee* was

as effective as HAIL, we would expect to see no effect of the HAIL treatment in the years when *Go Blue Guarantee* was in place. Instead, we see that HAIL still increased applications by 28 percentage-points and enrollment by 9 percentage-points above the control condition, where students were still eligible for the University's *Go Blue Guarantee*. We hypothesize that is because the *Go Blue Guarantee*, and policies like it, are not a "guarantee" at all. Students value ***certainty*** and telling students the price of attendance is ***zero*** is particularly effective.

Our paper leans on a literature that suggests this phenomenon is, at least in part, psychological (Tversky and Kahneman, 1986). While psychological, I would argue it is a very rational consideration. Students from families with low incomes experience uncertainty across a variety of dimensions, including food and housing insecurity. Rationally, they recognize these uncertainties may not go away when they start college (e.g. Jack, 2019; Goldrick-Rab, 2016). This uncertainty throughout their lives often leads students to make educational choices based on anticipation of financial and family shocks (DeLuca et al., 2021). Therefore, uncertainty about current and future tuition costs makes matters even worse (e.g. Dynarski et al., 2022; Dynarski and Scott-Clayton, 2013). However effective at identifying causal effects, randomized, controlled trials can only go so far in describing these mechanisms. Future qualitative work should directly study the role of ***certainty*** in the effectiveness of such financial aid interventions, and the uncertainty that conditional financial aid processes create.

The second empirical chapter made some progress towards this goal by identifying one underappreciated mechanism through which decision making occurs and define this resource through the experiences of the students in the study. However, this sample size was not large enough to describe the prevalence of this experience or the sources of heterogeneity. For example, future research should investigate the role of gender in the strength of the sibling influence. Additionally, heterogeneity by the age gap of the siblings may provide further insights into the necessary components of this relationship. It may be the case that siblings closer in age are better able to inform their siblings. However, it may also be the case that siblings who are much older than the student has had longer to recognize the outcomes from their postsecondary decisions. Finally, future

work should use this qualitative knowledge to inform a quantitative evaluation of sibling spillovers from positive policy interventions. Did the HAIL Scholarship intervention have positive effects on younger siblings who may not have been impacted directly by this intervention? Did it increase younger sibling academic achievement, or change college going patterns?

The first two extensions of this study can be achieved through analysis of the expanded interview sample that my collaborator, Stefanie DeLuca, and I have collected over the past three years. We have collected over 100 interviews with a stratified random sample of two subsequent HAIL Scholarship study cohorts, achieving a response rate of 70%. This high sample size plus response rate coverage will allow for an exploration of heterogeneity in experiences within the study population (see DeLuca (2022) for a discussion of the value of sample selection and transparency in qualitative research). This increased sample size will allow for the testing of these thematic findings of the role of siblings for prevalence in the larger sample and identify whether there is heterogeneity by age gap and sibling gender in the role of siblings in postsecondary decision-making. Beyond the role of siblings, this expanded interview sample will allow us to speak to broader experiences of uncertainty and the strategies students use to respond to their unequal circumstances as they transition to adulthood. Further, a sibling linkage in the administrative data would allow for the evaluation of policy spillovers: does HAIL affect younger sibling academic performance and college enrollment outcomes? This is relevant to this policy intervention and others. Knowing the integral role that siblings play in the educational choices of their younger siblings may mean that we underestimate the benefits of positive policies and overestimate the drawbacks of harmful policies.

The first two empirical chapters provide motivation for future qualitative evaluation, and the third chapter is no different. Further work is needed to identify causal mechanisms that drive rural decision making, and contribute to the correlation between students' neighborhood, school, and demographic characteristics and their postsecondary outcomes. Understanding these complex factors is necessary for deciding where to target future policy intervention. When systematic or purposive sampling is applied to a qualitative research design, qualitative interviews are well suited

to identifying these causal mechanisms and highlighting heterogeneity in experiences that drive inequality (DeLuca, 2022). Qualitative work that highlights how decision-making strategies differ across urbanicities, and the unique barriers that students in rural, city, and suburban places face would go a long way in developing policies that best address the unique barriers faced by students in different types of places, as well as the unique strategies they employ to respond to their circumstances. Future quantitative research may also want to consider more directly the institutional contexts of students and the ways these may shape college-going in certain places, including the different policies students in rural, city, and suburban areas are exposed to that may contribute to the postsecondary choices they make.

All three empirical chapters point to an important consideration when designing and implementing policies aimed at reducing inequality. This extends beyond general preparation for college transition or financial aid offers. Social policies need to target the actual barriers individuals face; failing to address actual needs will lead to less effective policies. Acknowledging the uncertainty that many individuals in need of social assistance face in their day to day lives, and the decision-making strategies that combat that instability in their lives and predicted uncertainty in their futures, can help us design more effective policies that remove administrative burdens and provide certainty. The design of policy should recognize the resources and supports students rely on, paying attention to students' trusted sources of information and how we can scale those resources to support all students in more equitable ways. Finally, policies cannot be one-size-fits all. Students face different barriers depending on their unique contexts. Policies that do not target the needs of students or over-generalized interventions will be less effective at reducing inequality.

# APPENDIX A

# Appendix to The Power of Certainty: Experimental Evidence on the Effective Design of Free Tuition Programs

# A.1 Intervention Materials

Exhibit A.1:
HAIL Student Letter

September 11, 2019

<<First_Name>> <<Last_Name>>
<<Person_Address1>>
<<Person_Address2>>
<<Person_City>>, <<Person_State>> <<Person_Postal>>

Dear <<First_Name>>,

As you are thinking about life after your senior year, we hope you are considering and will apply to the University of Michigan. You can put your incredible talents to work here in Ann Arbor – relatively close to home – where you will be surrounded by professors and resources to help you during your journey.

We believe you to be an academically excellent student who has worked hard for your achievements. If you apply to U-M and are admitted for the fall 2020 term, we will reward your hard work with the **HAIL Scholarship**, which covers the full cost of your in-state tuition for four years of study at our Ann Arbor campus. That's an approximate $66,000 value to you and your family.

Additionally, after a review of your financial aid applications, you will likely be eligible for additional aid to cover costs of housing, meals, textbooks, and other expenses.

The University of Michigan is an outstanding advantage for families in our state. Among all Michigan colleges, U-M students are the most likely to earn their degree, with 92% graduating in six years. When they do, they join a global base of more than 580,000 alumni who are eager to help them make connections and advance in their careers. Importantly, students who hold a U-M bachelor's degree earn 22% more annually than the national median, or $61,099, within five years after graduation. And 10 years after graduation that number rises to more than $85,000.

<<First_Name>>, please take a look at the enclosed materials and discuss this outstanding offer with your family. We look forward to receiving your application, with the fee waived, preferably by our Early Action deadline of November 1.

Similarly, please begin submitting your financial aid documents as of Oct. 1, when the FAFSA and CSS Profile become available. You do not need to wait until your application is complete to submit these documents. More information about applications to the university and for financial aid can be found at admissions.umich.edu.

Additionally, you may reach out with admissions questions to Dustin Castro in the Office of Undergraduate Admissions at 734-615-4008 or dcastro@umich.edu; or with financial aid questions to Raquel Arevalo in our Office of Financial Aid at 734-763-6600 or arevalor@umich.edu.

Go Blue!

Dr. Mark Schlissel
President

Exhibit A.2:
Go Blue Encouragement Student Letter

September 11, 2019

<<First_Name>> <<Last_Name>>
<<Person_Address1>>
<<Person_Address2>>
<<Person_City>>, <<Person_State>> <<Person_Postal>>

Dear <<First_Name>>,

As you are thinking about life after your senior year, we hope you are considering and will apply to the University of Michigan. You can put your incredible talents to work here in Ann Arbor – relatively close to home – where you will be surrounded by professors and resources to help you during your journey.

We believe you to be an academically excellent student who has worked hard for your achievements. That's why we hope you are planning to apply to the University of Michigan. Furthermore, our **Go Blue Guarantee** can help you with your college costs, as it covers the full cost of in-state tuition for in-state students who are admitted to the Ann Arbor campus and whose families earn incomes of $65,000 or less, with $50,000 or less in assets. If your family earns more, you can still Go Blue; we provide tuition support for families with incomes up to $180,000.

The University of Michigan is an outstanding advantage for families in our state. Among all Michigan colleges, U-M students are the most likely to earn their degree, with 92% graduating in six years. When they do, they join a global base of more than 580,000 alumni who are eager to help them make connections and advance in their careers. Importantly, students who hold a U-M bachelor's degree earn 22% more annually than the national median, or $61,099, within five years after graduation. And 10 years after graduation that number rises to more than $85,000.

<<First_Name>>, please take a look at the enclosed materials and discuss this outstanding offer with your family. We look forward to receiving your application, with the fee waived, preferably by our Early Action deadline of November 1.

Similarly, please begin submitting your financial aid documents as of Oct. 1, when the FAFSA and CSS Profile become available. You do not need to wait until your application is complete to submit these documents, and may receive additional aid to cover costs of housing, meals, textbooks, and other expenses. More information about applications to the university and for financial aid can be found at admissions.umich.edu.

Additionally, you may reach out with admissions questions to Dustin Castro in the Office of Undergraduate Admissions at 734-615-4008 or dcastro@umich.edu; or with financial aid questions to Jim Eddy in our Office of Financial Aid at 734-763-8424 or ofa-go.blue.guarantee@umich.edu.

Go Blue!

Dr. Mark Schlissel
President

Exhibit A.3:
HAIL Foldout (first page)

HAIL Foldout (second page)

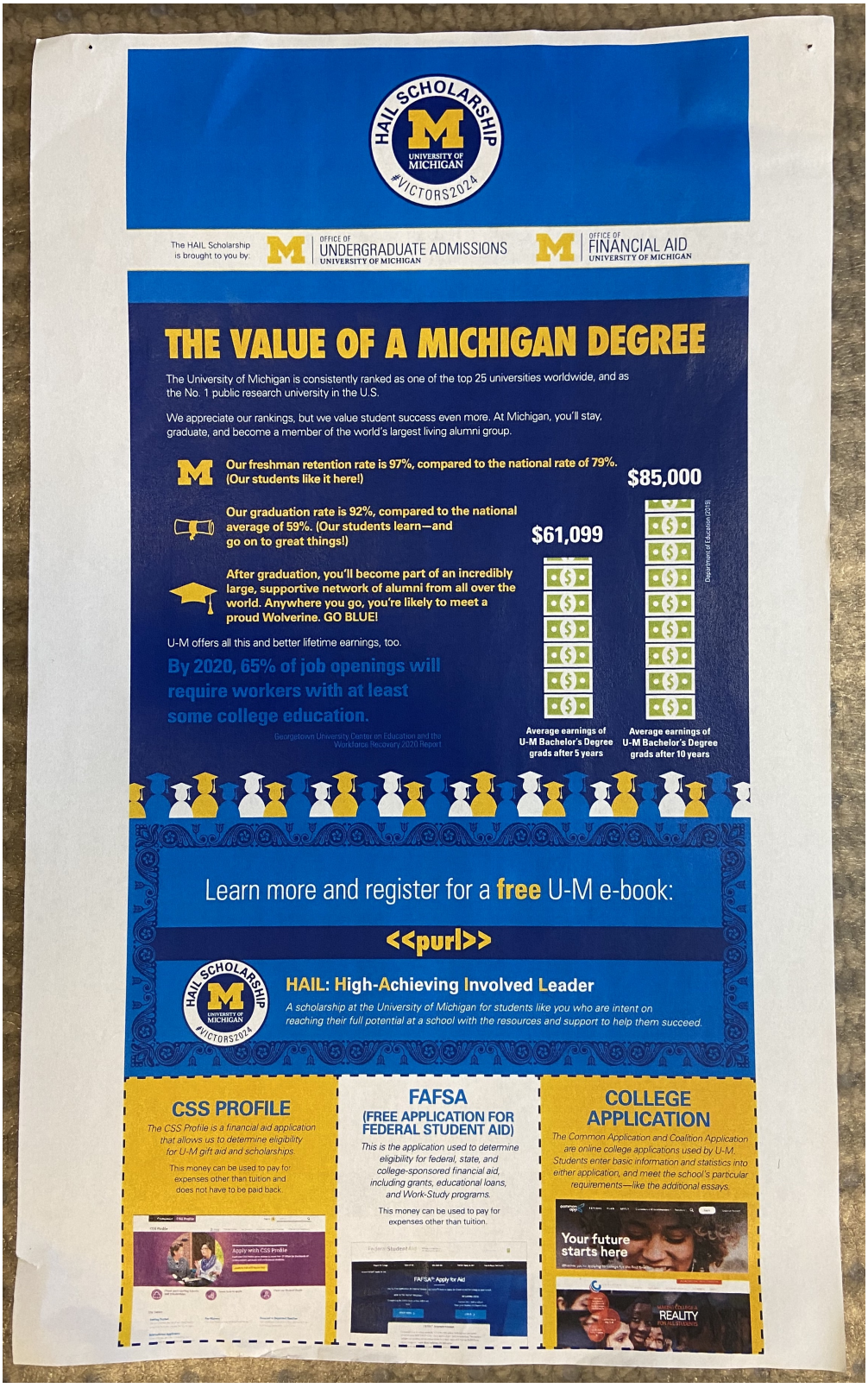
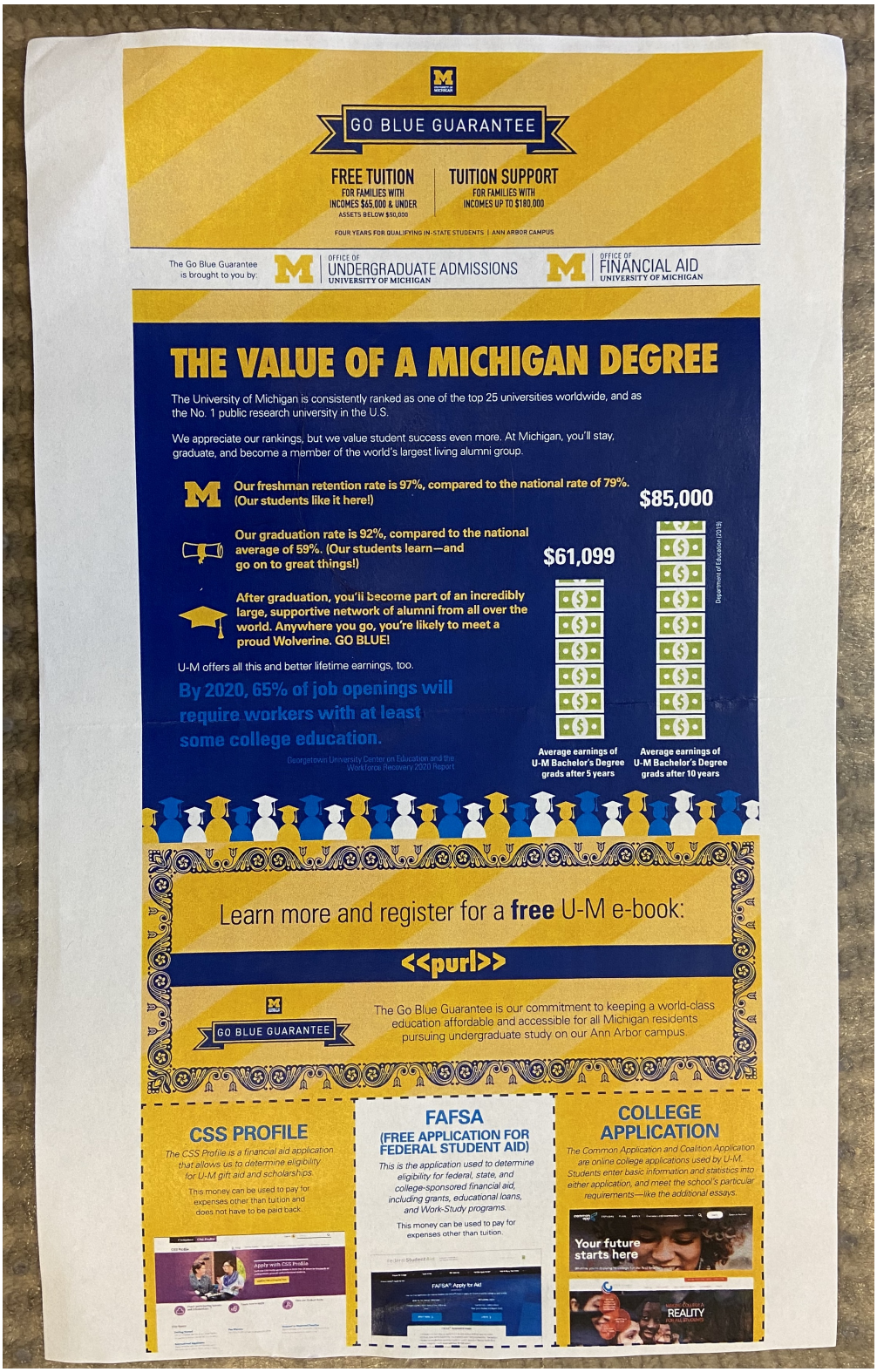


Exhibit A.4:
Go Blue Encouragement Foldout (first page)

Go Blue Encouragement Foldout (second page)



## A.2 Appendix Tables and Figures

## Appendix Table A.1:
## School-Level Balance

| Characteristic | (1) Control | (2) HAIL | (3) GB Encour. | (1) vs. (2) P-value | (1) vs. (3) P-value | (2) vs. (3) P-value | Joint F-test P-value |
|---|---|---|---|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.13 | 0.13 | 0.13 | 0.81 | 0.58 | 0.43 | 0.71 |
| | (0.13) | (0.12) | (0.12) | | | | |
| School in UP | 0.15 | 0.18 | 0.15 | 0.52 | 1.00 | 0.52 | 0.76 |
| | (0.36) | (0.38) | (0.36) | | | | |
| Town/rural school | 0.53 | 0.53 | 0.52 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.50) | (0.50) | (0.50) | | | | |
| Suburban school | 0.35 | 0.35 | 0.36 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.48) | (0.48) | (0.48) | | | | |
| Distance of school from UM (miles) | 98.9 | 104.1 | 97.5 | 0.55 | 0.85 | 0.39 | 0.68 |
| | (86.74) | (86.65) | (75.65) | | | | |
| UM application rate of school, class of 2015 | 0.07 | 0.07 | 0.06 | 0.89 | 0.60 | 0.56 | 0.81 |
| | (0.08) | (0.10) | (0.09) | | | | |
| Average ACT score of school, class of 2015 | 19.96 | 19.92 | 19.89 | 0.85 | 0.74 | 0.92 | 0.94 |
| | (1.85) | (2.06) | (2.07) | | | | |
| Proportion of sample students with A or A+ GPA | 0.86 | 0.87 | 0.84 | 0.74 | 0.47 | 0.30 | 0.56 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Proportion of sample students with A-, B+, or B GPA | 0.14 | 0.13 | 0.16 | 0.68 | 0.52 | 0.29 | 0.57 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Average SAT of sample students | 1260 | 1264 | 1262 | 0.55 | 0.86 | 0.65 | 0.83 |
| | (71.14) | (72.77) | (61.83) | | | | |
| Proportion female | 0.56 | 0.55 | 0.57 | 0.71 | 0.87 | 0.59 | 0.86 |
| | (0.35) | (0.36) | (0.34) | | | | |
| Proportion under-represented minority | 0.17 | 0.15 | 0.18 | 0.59 | 0.63 | 0.31 | 0.59 |
| | (0.28) | (0.27) | (0.29) | | | | |
| Proportion eligible for free lunch | 0.80 | 0.81 | 0.79 | 0.70 | 0.71 | 0.43 | 0.74 |
| | (0.28) | (0.25) | (0.28) | | | | |
| Average number of sample students | 3.8 | 3.7 | 3.7 | 0.79 | 0.76 | 0.96 | 0.95 |
| | (3.50) | (3.19) | (3.51) | | | | |
| Overall F-test p-value | | | | 1.00 | 1.00 | 0.93 | |
| Number of schools | 159 | 159 | 159 | 318 | 318 | 318 | 477 |
| Number of students | 610 | 595 | 591 | 1,205 | 1,201 | 1,186 | 1,796 |

Notes: All analyses conducted at the school level. P-values for each pair of treatment arms are from a t-test of the coefficient on treatment status from a regression of the characteristic on treatment and strata dummies. The joint F-test p-value for each characteristic is from a joint significance test of the coefficients on treatment dummies from a regression of the characteristic on treatment and strata dummies, run on all treatment arms. For each pair of treatment arms, the overall F-test p-value is from a joint significance test predicting treatment based on the characteristics listed here, excluding the summary index, as well as strata dummies. Standard deviations in parentheses. All regressions use robust standard errors. We rerandomized to achieve balance within region on all listed school characteristics, except the summary index and the proportion eligible for free lunch. Summary index calculated from parameters of an OLS regression estimating the relationship between observable characteristics and a binary indicator for attending a college as competitive as the University of Michigan. "Under-represented minority" includes all students who are Black, Hispanic, American Indian, or Native Hawaiian or Pacific Islander.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Appendix Table A.2:
Applicant Characteristics by Treatment Arm

| Characteristic | Control | HAIL | GB Encour. | Control vs. HAIL P-value | Control vs. GBE P-value | HAIL vs. GBE P-value |
|---|---|---|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.23 | 0.16 | 0.19 | 0.00 | 0.05 | 0.29 |
| School in UP | 0.07 | 0.14 | 0.07 | 0.07 | 0.77 | 0.10 |
| Town/rural school | 0.31 | 0.37 | 0.38 | 0.55 | 0.16 | 0.38 |
| Suburban school | 0.44 | 0.43 | 0.34 | 0.31 | 0.02 | 0.33 |
| Distance of school from UM (miles) | 78.0 | 89.8 | 73.3 | 0.24 | 0.67 | 0.08 |
| UM application rate of school, class of 2015 | 0.11 | 0.08 | 0.11 | 0.34 | 0.76 | 0.53 |
| Average ACT score of school, class of 2015 | 20.64 | 20.49 | 20.41 | 0.72 | 0.47 | 0.93 |
| A or A+ GPA | 0.90 | 0.87 | 0.89 | 0.22 | 0.70 | 0.52 |
| A-, B+, or B GPA | 0.10 | 0.13 | 0.10 | 0.25 | 0.78 | 0.48 |
| SAT | 1309 | 1285 | 1289 | 0.01 | 0.02 | 0.63 |
| Female | 0.54 | 0.55 | 0.55 | 0.94 | 0.79 | 0.93 |
| Under-represented minority | 0.18 | 0.15 | 0.18 | 0.53 | 0.97 | 0.66 |
| Eligible for free lunch | 0.83 | 0.76 | 0.81 | 0.05 | 0.64 | 0.24 |
| Average number of sample students at school | 7.6 | 6.6 | 7.5 | 0.51 | 0.86 | 0.65 |
| Overall F-test p-value | | | | 0.00 | 0.02 | 0.00 |
| Application rate | 0.38 | 0.63 | 0.46 | | | |
| Number of students | 229 | 373 | 269 | | | |

Notes: All analyses conducted at the student level. Treatment arm comparison p-values and overall F-test p-value computed as in Appendix Table as in Appendix Table A.1. All variables defined as in Appendix Table A.1.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

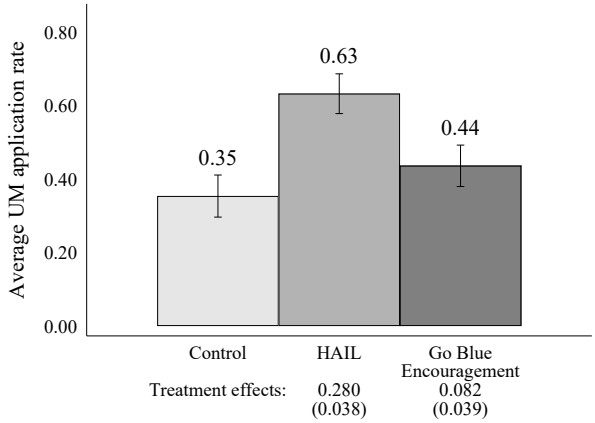
Appendix Table A.3:
Student Financial Aid Amounts by Treatment Arm

| | Focal Cohort | | | | | |
|---|---|---|---|---|---|---|
| | First Year | | | | | |
| | Mean | | | | | |
| | Control | HAIL | GBE | H-C | GBE-C | H-GBE |
| Grants | $25,432 | $26,676 | $25,172 | $1,244 | -$260 | $1,504 |
| | (918) | (423) | (690) | (1014) | (1152) | (812) |
| Loans | $1,217 | $956 | $1,419 | -$261 | $202 | -$463 |
| | (412) | (184) | (346) | (453) | (540) | (393) |
| Proportion with Grants $\geq$ Tuition | 0.886 | 1.000 | 0.873 | 0.114 | -0.013 | 0.127 |
| | (0.034) | (0.000) | (0.035) | (0.034) | (0.049) | (0.035) |
| Expected Family Contribution | $2,336 | $2,481 | $2,464 | $145 | $129 | $17 |
| | (605) | (524) | (564) | (803) | (830) | (773) |
| Cost of Tuition | | $15,960 | | | | |
| | | (132) | | | | |
| Number of students | 88 | 117 | 81 | | | |
| Number of students in the study | 610 | 595 | 591 | | | |

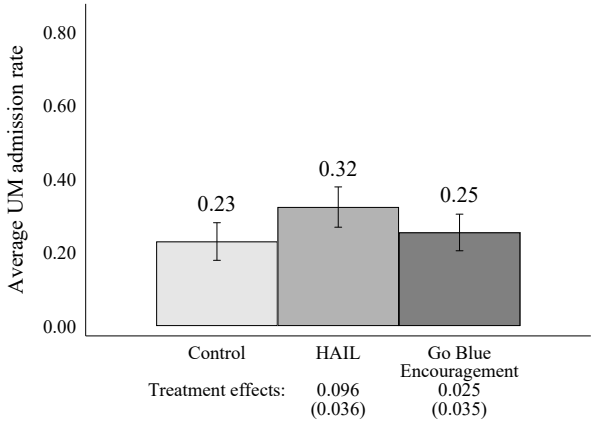
Notes: Analysis done at the student level. Includes only students enrolled at the University of Michigan full time for full first year and who have financial aid data reported. Standard errors are clustered at the school level. Includes zeros for students who receive no aid. "Total grant aid" includes all institutional and departmental scholarships and grants, federal grants, state grants and scholarships, and private scholarships, and other departmental aid. Expected family contribution is capped at the cost of attendance, as determined by the University of Michigan (includes tuition, fees, books and supplies, room and board, transportation, and personal expenses).
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

Appendix Figure A.1:
Estimated Effect of HAIL Scholarship and Go Blue Encouragement Treatments
on University of Michigan Application, Admission, and Enrollment

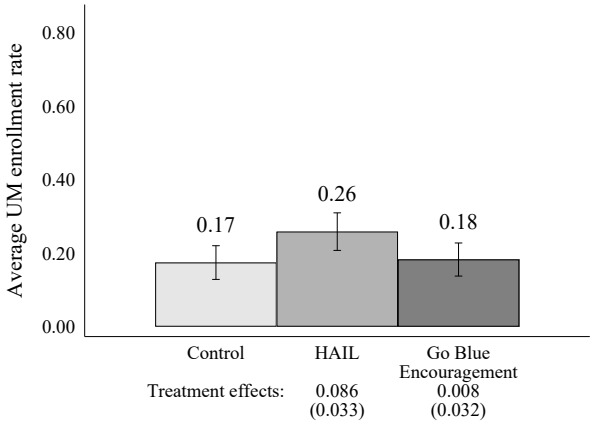
(a) Application to University of Michigan (UM)




(b) Admission to UM

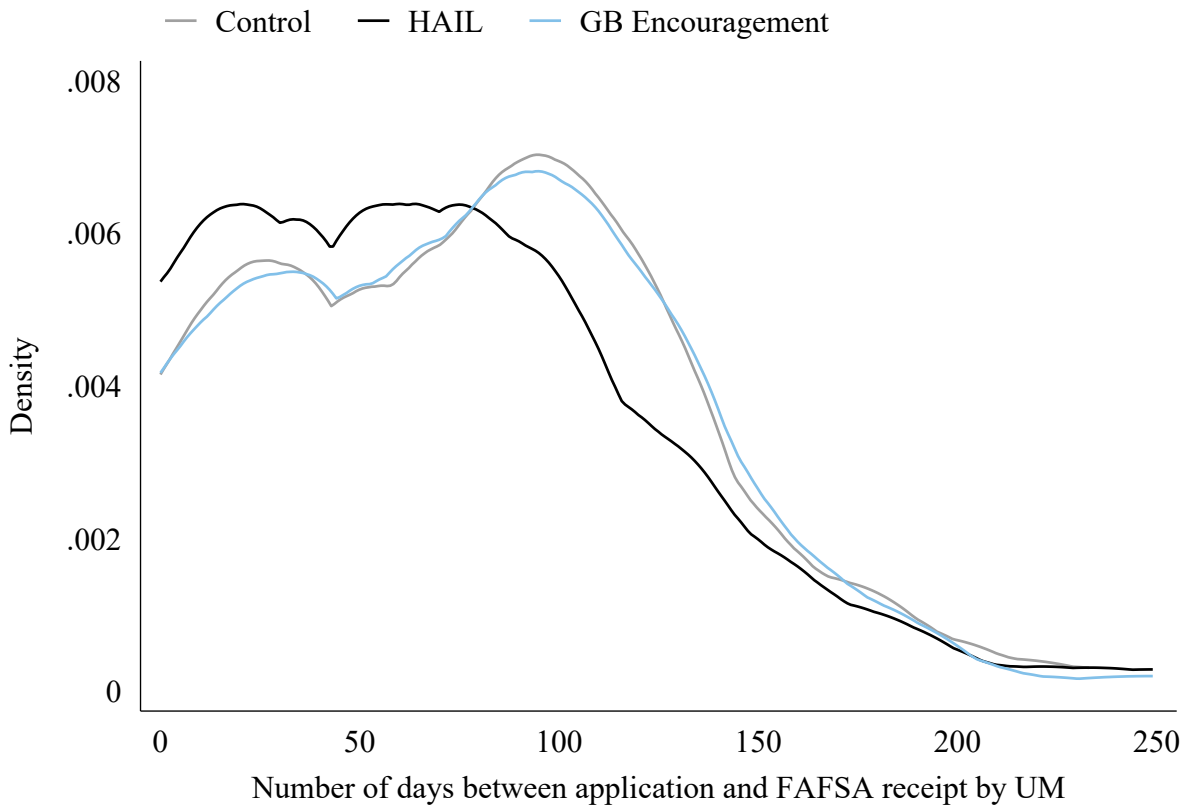



(c) Enrollment at UM




Notes: All analyses done at the school level. Treatment effect coefficients are from estimating Equation 2.1, a regression of the outcome on indicators for each treatment status (HAIL, Go Blue Encouragement), and strata indicators. The "HAIL" and "Go Blue Encouragement" treatment effects are estimates of $\beta_1$ and $\beta_2$, respectively. Robust standard errors reported in parentheses. Ninety-five percent confidence intervals shown based on robust standard errors. Application, admission, and enrollment measured in the summer and fall following expected high school graduation. Admission and enrollment are unconditional on application.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Appendix Figure A.2:
Days between Application to UM and UM Receipt of FAFSA Application

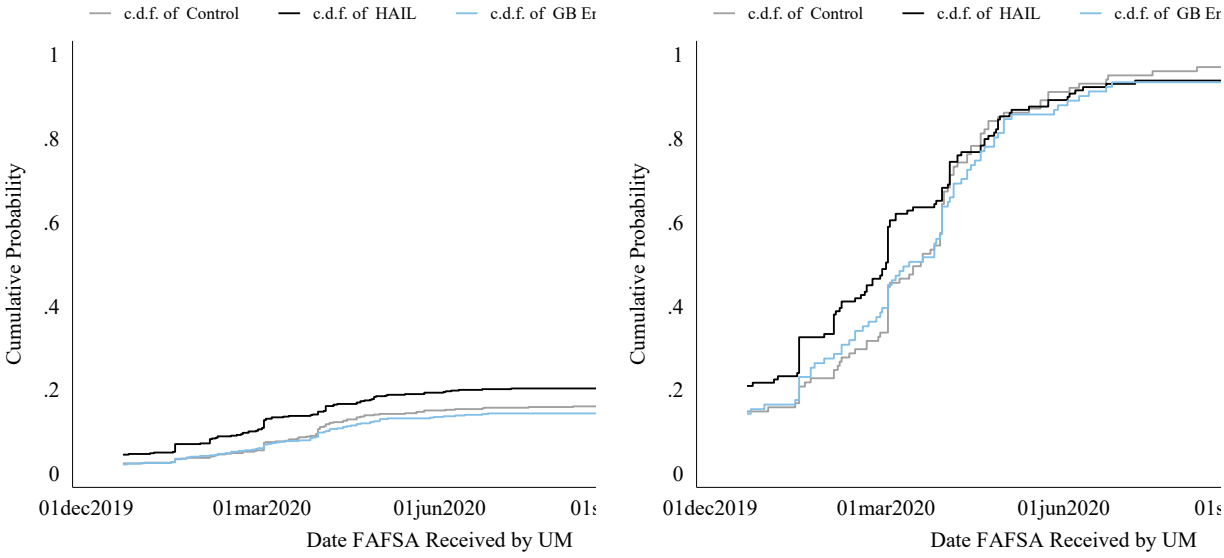



Notes: Figure plots the kernel density of days between application and when the FAFSA was received by the University of Michigan. The first recorded date of receipt by UM is December 20th, the day after early action admissions decisions were released. To calculate the number of days, we set the earliest application date at December 20th then calculated the FAFSA submission date from there, or the actual recorded date for those who apply later. Students who do not enroll at UM or file a FAFSA are excluded from this figure.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

Appendix Figure A.3:
Cumulative Distribution of the Dates FAFSA was received by UM

(a) Not Conditional on Enrollment at UM or filing FAFSA (N=1,976)

(b) Conditional on enrollment at UM, not conditional on filing FAFSA (N=321)

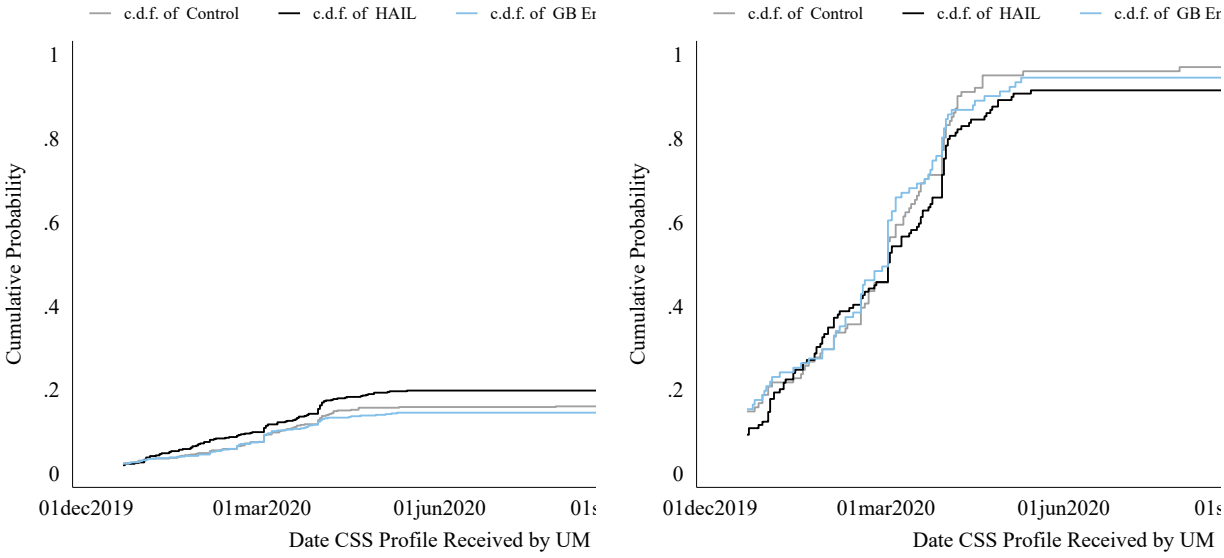



Notes: Figure plots the cumulative distribution of the date the FAFSA was received by the University of Michigan. The first recorded date of receipt by UM is December 20th, the day after early action admissions decisions were released. Panel A.3a includes the full HAIL sample, and therefore students who never have a FAFSA received by UM. Panel A.3b excludes students who do not enroll at UM.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

Appendix Figure A.4:
Cumulative Distribution of the Dates CSS Profile was received by UM

(a) Not Conditional on Enrollment at UM or filing CSS Profile (N=1,976)

(b) Conditional on enrollment at UM, not conditional on filing CSS Profile (N=321)




Notes: Figure plots the cumulative distribution of the date the CSS Profile was received by the University of Michigan. The first recorded date of receipt by UM is December 20th, the day after early action admissions decisions were released. Panel A.4a includes the full HAIL sample, and therefore students who never have a CSS Profile received by UM. Panel A.4b excludes students who do not enroll at UM.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022); University of Michigan Office of Financial Aid (2022).

# APPENDIX B

# Appendix to Following in their Footsteps or Avoiding their Mistakes: The Role of Older Siblings in Shaping College Choices

## B.1 Sample Selection and Response Rate

The students selected for the sample are all from families with low incomes, they qualify for free- or reduced- price lunch at school, and are considered high-achieving, based on a combination of high school grades and SAT score. These students were randomly sampled from the HAIL Scholarship sample, meaning all meet the qualifications for the scholarship as set by the University of Michigan. I randomly selected 66 total students from two of the four experimental strata: students from cities in southeast Michigan (where UM is located), and students who lived in rural areas outside of southeast Michigan. I oversampled rural students based on evidence from the HAIL scholarship study that this second group are least likely to apply to UM at baseline and are mostly likely to have their application and enrollment behavior changed by treatment, and the students from cities in the southeast Michigan are at the other extreme, more likely to apply at baseline and therefore less likely to be moved by treatment (Dynarski et al., 2021).

In April 2020, due to low response rate among the initial sample, I selected a nearest-neighbor matched sample for those students who had not yet responded to the call for participants. These "matches" replaced original sample members. This is to ensure adequate range on key sample characteristics and experiences, to ensure I was hearing stories from not only a select group of students. I conducted a nearest neighbor match in Stata for all those that had not yet been in contact as of April 2020. The goal of this was to replace the unresponsive sample members, but increase the likelihood of getting students more "like" the students in the original sample that were unresponsive. Each sample member was matched with their "nearest neighbor" using the program "mahapick" in Stata (which creates up to four "matches" for each sample member, and scores them based on closeness) and "mahauniqe" (which selects one unique match for each sample member) programs in Stata. This takes the nearest unique match for a student, ensuring that no "match" is paired with two additional sample members. When there's a tie, it selects randomly. Here are the criteria used to determine the "nearest neighbor": (1) Participants must be an exact match on: region, urbanicity, HAIL treatment status, gender, race category. (2) Participants need to be a "close" match on: SAT score, gpa category, distance to UM, number of HAIL students in their

school.

I removed two participants from the study prior to the scheduling of the interview due to ethical concerns related to COVID-19 that arose over the course of recruitment that led me to stop recruiting those students and parents. Additionally, I removed four participants from the sample due to bad addresses that resulted in the return of all letters sent, including the final letter which was sent by certified mail to ensure its arrival.[1] In total, I interviewed 36 students out of a reachable sample of 62, a 58% response rate. While lower than I would have liked, I do provide an analysis in Appendix Table B.2 below on those who did not respond to the call for participants so we can see how they differ from those that I did interview. In the results, I will address how this limitation may have biased the results of the study. Appendix Table B.2 below describes the original sample members, comparing those who did not respond to those who did. Students in the HAIL treatment group, female students, and students in the southeast were more likely to respond. However, looking at average SAT scores and average distance to UM, the "yes" and "no" groups look similar. Appendix Table B.3 shows the matched sample compared to the "no" responses from the first group. By design, they look the same on gender, race, strata (SE/urban v. non-SE/non-urban), and treatment status. They're also very similar on average SAT score, distance from UM, and GPA category.

[1]These students do not appear to be substantially different from the interviewed sample of students. There were four students who received a HAIL Scholarship and two who were in the control group, they were evenly spread across racial groups, were split between suburban and urban areas, and had similar average SAT scores to the interviewed group.

Appendix Table B.1:
Characteristics of Sample Selected for Interview Recruitment and Overall HAIL Sample

| | Selected for Sample | | Overall HAIL Sample |
|---|---|---|---|
| Characteristic | Number | Proportion | Proportion |
| Region | | | |
| Outside Southeast MI | 42 | 0.64 | 0.66 |
| Southeast | 24 | 0.36 | 0.34 |
| Urbanicity | | | |
| Town or Rural | 28 | 0.42 | 0.43 |
| City | 24 | 0.36 | 0.16 |
| Suburban | 14 | 0.21 | 0.41 |
| Student Demographics | | | |
| Female | 38 | 0.58 | 0.55 |
| Male | 28 | 0.42 | 0.45 |
| Black | 7 | 0.11 | 0.07 |
| Asian American | 6 | 0.09 | 0.11 |
| Hispanic | 10 | 0.15 | 0.07 |
| White | 47 | 0.71 | 0.8 |
| American Indian, Native Hawaiian, or Alaskan Native | 5 | 0.08 | 0.03 |
| Student Academics | | | |
| Grade Average: A+ or A | 58 | 0.88 | 0.83 |
| Avg. SAT Composite Score | | 1254 | 1269 |
| HAIL Study Treatment Status | | | |
| Control Group Student | 22 | 0.33 | 0.34 |
| Student Received HAIL Scholarship | 22 | 0.33 | 0.33 |
| Student Received Go Blue Encouragement | 22 | 0.33 | 0.33 |
| Number of students | | 66 | 1,796 |

Notes: Table reports information from administrative data. Selected for sample are those randomly selected to be recruited for interviews. The overall HAIL sample is the experimental sample that these students were selected from. Race and ethnicity are not mutually exclusive categories so they may not add up to the total number of interviews.
Source: Michigan's Center for Educational Performance and Information (2022b,a).

Appendix Table B.2:
Characteristics of Recruited Students who Participated in an Interview and Recruited Students that Did Not

| | Contact Made (as of April 2020) | | | |
|---|---|---|---|---|
| | No | | Yes | |
| Treatment Group | | | | |
| Control | 17 | 33% | 5 | 33% |
| HAIL | 15 | 29% | 7 | 47% |
| GBG | 19 | 37% | 3 | 20% |
| Experimental Strata | | | | |
| Southeast urban | 17 | 33% | 7 | |
| Non-southeast non-urban | 34 | 67% | 8 | |
| Student Characteristics | | | | |
| Male | 24 | 47% | 4 | 27% |
| Female | 27 | 53% | 11 | 73% |
| White or Asian American | 37 | 73% | 9 | 60% |
| Black | 3 | 6% | 2 | 13% |
| Other race | 11 | 22% | 4 | 27% |
| GPA Category | | | | |
| A+ | 27 | 53% | 11 | 73% |
| A | 16 | 31% | 4 | 27% |
| A- | 6 | 12% | 0 | 0% |
| B+ | 2 | 4% | 0 | 0% |
| Average SAT | 1263 | – | 1222 | – |
| Distance from the University of Michigan (miles) | 85 | – | 93 | – |
| N | 51 | | 15 | |

Notes: Table reports sample numbers that were used to decide to conduct a nearest-neighbor matching process to select additional sample members for recruitment. Students who had not yet reached out for an interview as of April 2020 were included in the match process.
Source: Michigan's Center for Educational Performance and Information (2022b,a).

Appendix Table B.3:
Characteristics of Matched Sample Relative to Original Sample Non Responders

| | Original Sample Non Responders | Matched Sample |
|---|---|---|
| HAIL Study Treatment Status | | |
| Control | 17 | 17 |
| HAIL | 15 | 15 |
| Go Blue Encouragement | 18 | 18 |
| Experimental Strata | | |
| Southeast urban | 16 | 16 |
| Non-Southeast non-urban | 34 | 34 |
| Student Characteristics | | |
| Male | 24 | 24 |
| Female | 26 | 26 |
| White or Asian American | 37 | 37 |
| Black | 2 | 2 |
| Other Race | 11 | 11 |
| GPA Category | | |
| A+ | 26 | 23 |
| A | 16 | 20 |
| A- or B+ | 8 | 7 |
| Average SAT Score | 1264 | 1244 |
| Distance from the University of Michigan (miles) | 86 | 88 |
| Number of Students | 50 | 50 |

Notes: The first column represents the characteristics of students who had not responded to our invitation to participate in an interview. The second column represents the matched sample, those students selected for interview recruitment based on the nearest-neighbor matching. The procedure forced an exact match on treatment status, strata, sex, and race. Nearest match on academic criteria and distance from UM.
Source: Michigan's Center for Educational Performance and Information (2022b,a).

## B.2 Testing for interaction between qualitative and experimental samples

This qualitative work was part of an ongoing experiment looking to evaluate not only short term, but also long-term outcomes. Therefore, we took additional steps to both ensure we were maintaining the integrity of the experimental design. This is described in depth in the sampling design. We also took steps to evaluate, post-hoc, whether our interviews had any impact on experimental effects.

### B.2.1 Experimental Sample Balance, Pre-Interview

To make sure the experimental sample remained balanced, prior to contacting the interview sample, I ran our experimental balance tests with two added indicators: "Selected for interview sample" which is a 1 for the 66 students randomly selected to be in the qualitative sample, and an indicator for "Total targeted for interview", which is a 1 for the 116 students who are either in that original sample, or part of the matched samples (selected based on the nearest neighbor matching described in the previous appendix section). Appendix Table B.4 shows the balance table with these indicators included. Both qualitative sample indicators are balanced, and the overall F-test for joint significance shows overall balance. Results separately by region are consistent with these results. The balance tables can be compared with Appendix Table 1 in Burland et al. (forthcoming), which shows that the experimental sample is balanced after randomization.

### B.2.2 Post-Interview Evaluation of Interaction Between Interview and Experimental Results

After interviews were completed, I evaluated whether including the interview sample impacted the experimental results. First, I included an indicator for "was interviewed" and "was contacted for interview" in the balance analysis. Appendix Table B.5 shows the balance table, including these

indicators. The sample is still balanced with these indicators included. Finally, because interview sample selection was conducted at the student-level, I also show student-level characteristics by treatment in Appendix Table B.6. This corresponds to Appendix Table 2 in Burland et al. (forthcoming).

Panel A in Appendix Table B.7 has the original treatment effects for this analysis that replicate those found in Burland et al. (forthcoming). Panels B and C, respectively show the main effects for this cohort, including an indicator for "was interviewed," and then an indicator for "was contacted for interview." The treatment effects shift only slightly, by approximately 0.001-0.002. Appendix Table B.8 shows the same results, conducted at the student-level which show similar results. The results are also robust to dropping interviewed students completely.

Appendix Table B.4:
Pre-Interview Experimental Sample Balance Check

| Characteristic | (1) Control | (2) HAIL | (3) GB Encour. | (1) vs. (2) P-value | (1) vs. (3) P-value | (2) vs. (3) P-value | Joint F-test P-value |
|---|---|---|---|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.13 | 0.13 | 0.13 | 0.81 | 0.58 | 0.43 | 0.71 |
| | (0.13) | (0.13) | (0.13) | | | | |
| School in UP | 0.15 | 0.18 | 0.15 | 0.52 | 1.00 | 0.52 | 0.76 |
| | (0.36) | (0.38) | (0.36) | | | | |
| Town/rural school | 0.53 | 0.53 | 0.52 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.50) | (0.50) | (0.50) | | | | |
| Suburban school | 0.35 | 0.35 | 0.36 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.48) | (0.48) | (0.48) | | | | |
| Distance of school from UM (miles) | 98.9 | 104.1 | 97.5 | 0.55 | 0.85 | 0.39 | 0.68 |
| | (86.74) | (86.65) | (75.65) | | | | |
| UM application rate of school, class of 2015 | 0.07 | 0.07 | 0.06 | 0.89 | 0.60 | 0.56 | 0.81 |
| | (0.08) | (0.10) | (0.09) | | | | |
| Average ACT score of school, class of 2015 | 19.96 | 19.92 | 19.89 | 0.85 | 0.74 | 0.92 | 0.94 |
| | (1.85) | (2.06) | (2.07) | | | | |
| Proportion of sample students with A or A+ GPA | 0.86 | 0.87 | 0.84 | 0.74 | 0.47 | 0.30 | 0.56 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Proportion of sample students with A-, B+, or B GPA | 0.14 | 0.13 | 0.16 | 0.68 | 0.52 | 0.29 | 0.57 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Average SAT of sample students | 1260 | 1264 | 1262 | 0.55 | 0.86 | 0.65 | 0.83 |
| | (71.14) | (72.77) | (61.83) | | | | |
| Proportion female | 0.56 | 0.55 | 0.57 | 0.71 | 0.87 | 0.59 | 0.86 |
| | (0.35) | (0.36) | (0.34) | | | | |
| Proportion under-represented minority | 0.17 | 0.15 | 0.18 | 0.59 | 0.63 | 0.31 | 0.59 |
| | (0.28) | (0.27) | (0.29) | | | | |
| Proportion eligible for free lunch | 0.80 | 0.81 | 0.79 | 0.70 | 0.71 | 0.43 | 0.74 |
| | (0.28) | (0.25) | (0.28) | | | | |
| Average number of sample students | 3.8 | 3.7 | 3.7 | 0.79 | 0.76 | 0.96 | 0.95 |
| | (3.50) | (3.19) | (3.51) | | | | |
| Contacted to Participate in an Interview | 0.02 | 0.01 | 0.01 | 0.44 | 0.33 | 0.87 | 0.62 |
| | (0.12) | (0.07) | (0.05) | | | | |
| Overall F-test p-value | | | | 1.00 | 1.00 | 0.93 | |
| Number of schools | 159 | 159 | 159 | 318 | 318 | 318 | 477 |
| Number of students | 610 | 595 | 591 | 1,205 | 1,201 | 1,186 | 1,796 |

Notes: Compare this with Appendix Table 1 in Burland et al. (forthcoming). All analyses conducted at the school level. P-values for each pair of treatment arms are from a t-test of the coefficient on treatment status from a regression of the characteristic on treatment and strata dummies. The joint F-test p-value for each characteristic is from a joint significance test of the coefficients on treatment dummies from a regression of the characteristic on treatment and strata dummies, run on all treatment arms. For each pair of treatment arms, the overall F-test p-value is from a joint significance test predicting treatment based on the characteristics listed here, excluding the summary index, as well as strata dummies. Standard deviations in parentheses. All regressions use robust standard errors. We re-randomized to achieve balance within region on all listed school characteristics, except the summary index and the proportion eligible for free lunch. Summary index calculated from parameters of an OLS regression estimating the relationship between observable characteristics and a binary indicator for attending a college as competitive as the University of Michigan. "Under-represented minority" includes all students who are Black, Hispanic, American Indian, or Native Hawaiian or Pacific Islander.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Appendix Table B.5:
Post-Interview Experimental Sample Balance Check

| Characteristic | (1) Control | (2) HAIL | (3) GB Encour. | (1) vs. (2) P-value | (1) vs. (3) P-value | (2) vs. (3) P-value | Joint F-test P-value |
|---|---|---|---|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.13 | 0.13 | 0.13 | 0.81 | 0.58 | 0.43 | 0.71 |
| | (0.13) | (0.13) | (0.13) | | | | |
| School in UP | 0.15 | 0.18 | 0.15 | 0.52 | 1.00 | 0.52 | 0.76 |
| | (0.36) | (0.38) | (0.36) | | | | |
| Town/rural school | 0.53 | 0.53 | 0.52 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.50) | (0.50) | (0.50) | | | | |
| Suburban school | 0.35 | 0.35 | 0.36 | 1.00 | 0.78 | 0.77 | 0.95 |
| | (0.48) | (0.48) | (0.48) | | | | |
| Distance of school from UM (miles) | 98.9 | 104.1 | 97.5 | 0.55 | 0.85 | 0.39 | 0.68 |
| | (86.74) | (86.65) | (75.65) | | | | |
| UM application rate of school, class of 2015 | 0.07 | 0.07 | 0.06 | 0.89 | 0.60 | 0.56 | 0.81 |
| | (0.08) | (0.10) | (0.09) | | | | |
| Average ACT score of school, class of 2015 | 19.96 | 19.92 | 19.89 | 0.85 | 0.74 | 0.92 | 0.94 |
| | (1.85) | (2.06) | (2.07) | | | | |
| Proportion of sample students with A or A+ GPA | 0.86 | 0.87 | 0.84 | 0.74 | 0.47 | 0.30 | 0.56 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Proportion of sample students with A-, B+, or B GPA | 0.14 | 0.13 | 0.16 | 0.68 | 0.52 | 0.29 | 0.57 |
| | (0.24) | (0.22) | (0.26) | | | | |
| Average SAT of sample students | 1260 | 1264 | 1262 | 0.55 | 0.86 | 0.65 | 0.83 |
| | (71.14) | (72.77) | (61.83) | | | | |
| Proportion female | 0.56 | 0.55 | 0.57 | 0.71 | 0.87 | 0.59 | 0.86 |
| | (0.35) | (0.36) | (0.34) | | | | |
| Proportion under-represented minority | 0.17 | 0.15 | 0.18 | 0.59 | 0.63 | 0.31 | 0.59 |
| | (0.28) | (0.27) | (0.29) | | | | |
| Proportion eligible for free lunch | 0.80 | 0.81 | 0.79 | 0.70 | 0.71 | 0.43 | 0.74 |
| | (0.28) | (0.25) | (0.28) | | | | |
| Average number of sample students | 3.8 | 3.7 | 3.7 | 0.79 | 0.76 | 0.96 | 0.95 |
| | (3.50) | (3.19) | (3.51) | | | | |
| Participated in an Interview | 0.02 | 0.02 | 0.02 | 0.41 | 0.91 | 0.44 | 0.66 |
| | (0.09) | (0.09) | (0.07) | | | | |
| Contacted to Participate in an Interview | 0.05 | 0.07 | 0.05 | 0.12 | 0.91 | 0.20 | 0.28 |
| | (0.15) | (0.19) | (0.14) | | | | |
| Overall F-test p-value | | | | 1.00 | 1.00 | 0.93 | |
| Number of schools | 159 | 159 | 159 | 318 | 318 | 318 | 477 |
| Number of students | 610 | 595 | 591 | 1,205 | 1,201 | 1,186 | 1,796 |

Notes: Compare this with Appendix Table 1 in Burland et al. (forthcoming). All analyses conducted at the school level. P-values for each pair of treatment arms are from a t-test of the coefficient on treatment status from a regression of the characteristic on treatment and strata dummies. The joint F-test p-value for each characteristic is from a joint significance test of the coefficients on treatment dummies from a regression of the characteristic on treatment and strata dummies, run on all treatment arms. For each pair of treatment arms, the overall F-test p-value is from a joint significance test predicting treatment based on the characteristics listed here, excluding the summary index, as well as strata dummies. Standard deviations in parentheses. All regressions use robust standard errors. We re-randomized to achieve balance within region on all listed school characteristics, except the summary index and the proportion eligible for free lunch. Summary index calculated from parameters of an OLS regression estimating the relationship between observable characteristics and a binary indicator for attending a college as competitive as the University of Michigan. "Under-represented minority" includes all students who are Black, Hispanic, American Indian, or Native Hawaiian or Pacific Islander.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Appendix Table B.6:
Post-Interview, Student-level Applicant Characteristics by Treatment Arm

| Characteristic | Control | HAIL | GB Encour. | Control vs. HAIL P-value | Control vs. GBE P-value | HAIL vs. GBE P-value |
|---|---|---|---|---|---|---|
| Pred. prob. of highly selective college attendance | 0.23 | 0.16 | 0.19 | 0.00 | 0.05 | 0.29 |
| School in UP | 0.07 | 0.14 | 0.07 | 0.07 | 0.77 | 0.10 |
| Town/rural school | 0.31 | 0.37 | 0.38 | 0.55 | 0.16 | 0.38 |
| Suburban school | 0.44 | 0.43 | 0.34 | 0.31 | 0.02 | 0.33 |
| Distance of school from UM (miles) | 78.0 | 89.8 | 73.3 | 0.24 | 0.67 | 0.08 |
| UM application rate of school, class of 2015 | 0.11 | 0.08 | 0.11 | 0.34 | 0.76 | 0.53 |
| Average ACT score of school, class of 2015 | 20.64 | 20.49 | 20.41 | 0.72 | 0.47 | 0.93 |
| A or A+ GPA | 0.90 | 0.87 | 0.89 | 0.22 | 0.70 | 0.52 |
| A-, B+, or B GPA | 0.10 | 0.13 | 0.10 | 0.25 | 0.78 | 0.48 |
| SAT | 1309 | 1285 | 1289 | 0.01 | 0.02 | 0.63 |
| Female | 0.54 | 0.55 | 0.55 | 0.94 | 0.79 | 0.93 |
| Under-represented minority | 0.18 | 0.15 | 0.18 | 0.53 | 0.97 | 0.66 |
| Eligible for free lunch | 0.83 | 0.76 | 0.81 | 0.05 | 0.64 | 0.24 |
| Average number of sample students at school | 7.6 | 6.6 | 7.5 | 0.51 | 0.86 | 0.65 |
| Participated in an Interview | 0.03 | 0.03 | 0.02 | 0.43 | 0.66 | 0.14 |
| Contacted for Interview | 0.08 | 0.06 | 0.06 | 0.36 | 0.80 | 0.22 |
| Overall F-test p-value | | | | 0.00 | 0.02 | 0.00 |
| Application rate | 0.38 | 0.63 | 0.46 | | | |
| Number of students | 229 | 373 | 269 | | | |

Notes: Compare to Appendix Table 2 in Burland et al. (forthcoming). All analyses conducted at the student level. P-values for each pair of treatment arms are from a t-test of the coefficient on treatment status from a regression of the characteristic on treatment and strata dummies. The joint F-test p-value for each characteristic is from a joint significance test of the coefficients on treatment dummies from a regression of the characteristic on treatment and strata dummies, run on all treatment arms. For each pair of treatment arms, the overall F-test p-value is from a joint significance test predicting treatment based on the characteristics listed here, excluding the summary index, as well as strata dummies. Summary index calculated from parameters of an OLS regression estimating the relationship between observable characteristics and a binary indicator for attending a college as competitive as the University of Michigan. "Under-represented minority" includes all students who are Black, Hispanic, American Indian, or Native Hawaiian or Pacific Islander.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

# Appendix Table B.7:
# HAIL Scholarship and Go Blue Encouragement Treatments and College Choice Outcomes

| | Panel A: HAIL Estimated Treatment Effects (replicates Table 2 in Burland et al. forthcoming) | | | Panel B: Control for Indicator for Participation in an Interview | | | Panel C: Control for Indicator of Recruited for Interview and for Participation in an Interview | | |
|---|---|---|---|---|---|---|---|---|---|
| Outcome | Treatment Effect | | | Treatment Effect | | | Treatment Effect | | |
| | HAIL | Go Blue Encouragement | HAIL vs. GBE. | HAIL | Go Blue Encouragement | HAIL vs. GBE. | HAIL | Go Blue Encouragement | HAIL vs. GBE. |
| Applied to University of Michigan | 0.280 | 0.082 | 0.198 | 0.279 | 0.082 | 0.197 | 0.282 | 0.082 | 0.199 |
| | (0.038) | (0.039) | (0.038) | (0.038) | (0.039) | (0.038) | (0.038) | (0.039) | (0.038) |
| | | [0.354] | | | [0.354] | | | [0.354] | |
| Admitted to University of Michigan | 0.096 | 0.025 | 0.071 | 0.094 | 0.024 | 0.069 | 0.097 | 0.025 | 0.072 |
| | (0.036) | (0.035) | (0.037) | (0.037) | (0.035) | (0.037) | (0.036) | (0.035) | (0.036) |
| | | [0.230] | | | [0.230] | | | [0.230] | |
| Enrolled at Universtiy of Michigan | 0.086 | 0.008 | 0.077 | 0.084 | 0.008 | 0.076 | 0.085 | 0.008 | 0.077 |
| | (0.033) | (0.032) | (0.034) | (0.033) | (0.032) | (0.034) | (0.033) | (0.032) | (0.034) |
| | | [0.174] | | | [0.174] | | | [0.174] | |
| Strata indicators | | X | | | X | | | X | |
| Indicator: Student Recruited for Interview | | | | | | | | X | |
| Indicator: Student Interviewed | | | | | X | | | X | |
| Number of Schools | | 477 | | | 477 | | | 477 | |
| Number of Students | | 1,796 | | | 1,796 | | | 1,796 | |

Notes: All analyses at the school level. Robust standard errors reported in parentheses. Results from a regression of the outcome on indicators for each treatment status. Control means are in square brackets. The difference, and standard error of the difference, between the HAIL and Go Blue Encouragement effect coefficients reported in the right-most column. UM application, admission and enrollment are measured in the summer and fall following expected high school graduation. Admission and enrollment are unconditional on application.

Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

Appendix Table B.8:
HAIL Scholarship and Go Blue Encouragement Treatments and College Choice Outcomes (Student-Level Analysis)

| Panel A: Estimated Treatment Effects (replicates Table 2 in Burland et al. forthcoming) | | | |
|---|---|---|---|
| Outcome | Treatment Effect | | |
| | HAIL | Go Blue Encouragement | HAIL vs. GBE. |
| Applied to University of Michigan | 0.240 | 0.070 | 0.170 |
| | (0.032) | (0.031) | (0.030) |
| | | [0.375] | |
| Admitted to University of Michigan | 0.052 | 0.019 | 0.031 |
| | (0.027) | (0.027) | (0.027) |
| | | [0.225] | |
| Enrolled at Universtiy of Michigan | 0.052 | -0.008 | 0.060 |
| | (0.026) | (0.025) | (0.027) |
| | | [0.166] | |
| Strata indicators | | X | |
| Indicator: Student Recruited for Interview | | | |
| Indicator: Student Interviewed | | | |
| Number of Schools | | 477 | |
| Number of Students | | 1,796 | |

| | Panel B: Control for Indicator for Participation in an Interview | | | Panel C: Control for Indicator of Recruited for Interview and for Participation in an Interview | | |
|---|---|---|---|---|---|---|
| Outcome | Treatment Effect | | | Treatment Effect | | |
| | HAIL | Go Blue Encouragement | HAIL vs. GBE. | HAIL | Go Blue Encouragement | HAIL vs. GBE. |
| Applied to University of Michigan | 0.239 | 0.070 | 0.169 | 0.240 | 0.070 | 0.170 |
| | (0.032) | (0.030) | (0.030) | (0.032) | (0.031) | (0.030) |
| | | [0.375] | | [0.375] | | |
| Admitted to University of Michigan | 0.049 | 0.018 | 0.030 | 0.049 | 0.019 | 0.030 |
| | (0.027) | (0.027) | (0.027) | (0.027) | (0.027) | (0.027) |
| | | [0.225] | | [0.225] | | |
| Enrolled at Universtiy of Michigan | 0.051 | -0.008 | 0.060 | 0.052 | -0.008 | 0.060 |
| | (0.026) | (0.025) | (0.027) | (0.026) | (0.025) | (0.027) |
| | | [0.166] | | [0.166] | | |
| Strata indicators | | X | | | X | |
| Indicator: Student Recruited for Interview | | | | | X | |
| Indicator: Student Interviewed | | X | | | X | |
| Number of Schools | | 477 | | | 477 | |
| Number of Students | | 1,796 | | | 1,796 | |

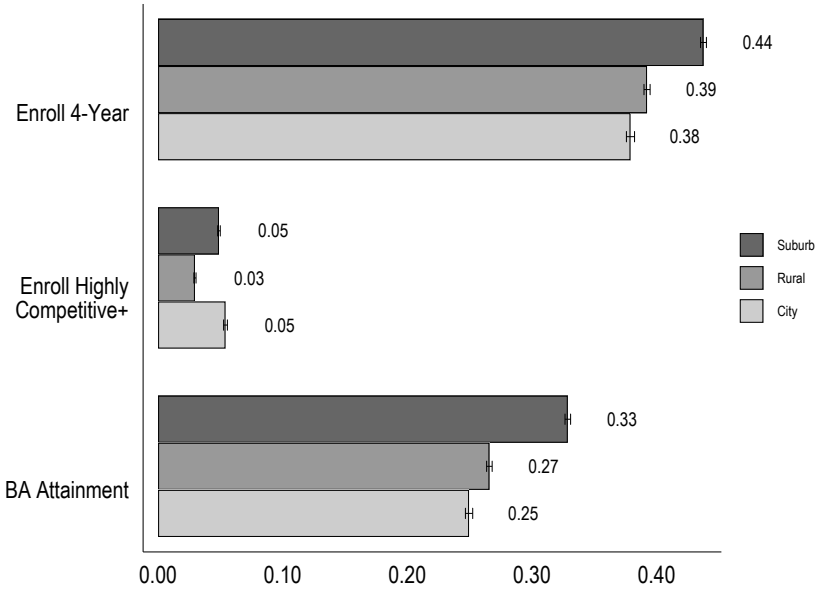
Notes: Analysis at the student-level. Robust standard errors, clustered at the school-level, reported in parentheses. Results from a regression of the outcome on indicators for each treatment status. Control means are in square brackets. The difference, and standard error of the difference, between the HAIL and Go Blue Encouragement effect coefficients reported in the right-most column. UM application, admission and enrollment are measured in the summer and fall following expected high school graduation. Admission and enrollment are unconditional on application.
Source: Michigan's Center for Educational Performance and Information (2022b,a); University of Michigan Office of Enrollment Management (2022).

# APPENDIX C

# Appendix to Varying Contexts, Varying Consequences: Geographic Inequality in Educational Attainment

## C.1 Restricting Sample to High School Graduates Only

The primary analysis uses a sample of 9th grade students and tracks whether they enroll in post-secondary education or compete a bachelor's degree. Students who drop out of high school, and do not enroll in postsecondary education "on time" get coded as a zero. However, to some extent this is looking at joint outcomes: high school graduation and college enrollment/completion. This is in contrast to many studies that instead use high school graduating cohorts, which excludes students who did not complete high school. Appendix Table C.1 shows descriptive statistics for the sample of high school graduates. Next, the following figures replicate Figure 4.1 and Figure 4.4 for a sample of high school graduates. Finally, Appendix Table C.2 replicates Table 4.3 using the sample of high school graduates.




Appendix Figure C.1:
Overall College Enrollment and Completion by Urbanicity
for Michigan Public High School Graduates

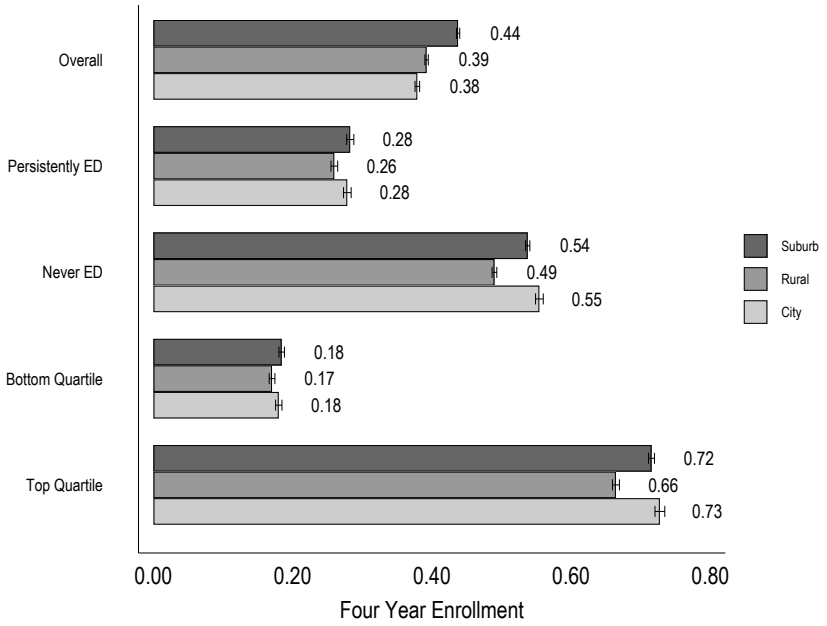
*Notes:* Rates calculated for Michigan public high school graduates (graduating between 2010-2013). Enrollment rates calculated in the fall following high school graduation. Bachelor's degree attainment is measured in the spring of the 6th year following high school graduation.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a).

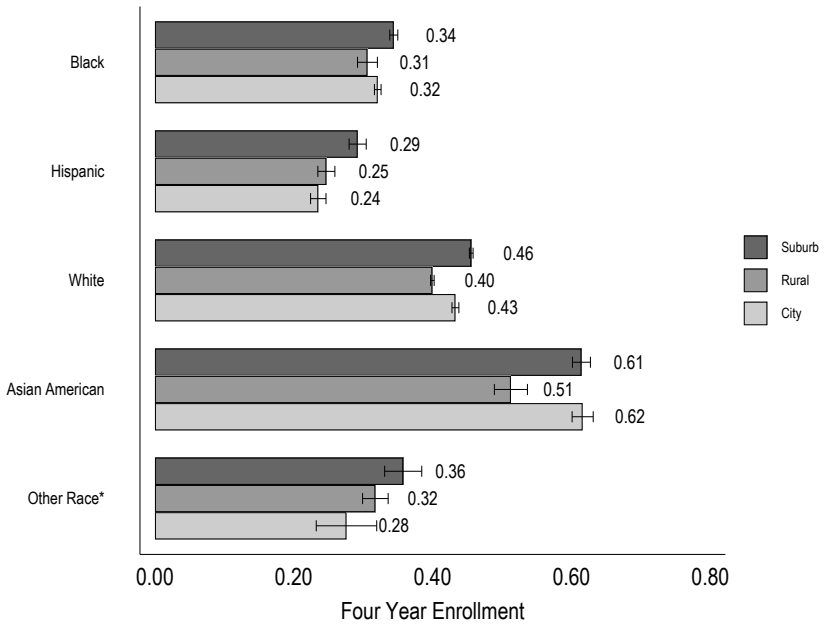
Appendix Table C.1:
Sample Characteristics: Michigan Public High School Graduates (2010-2013)

| | Overall | Suburb | City | Town/Rural |
|---|---|---|---|---|
| Student Characteristics | | | | |
| Black | .165 | .155 | .434 | .026 |
| White | .756 | .771 | .446 | .911 |
| Hispanic | .04 | .033 | .066 | .033 |
| Asian American | .028 | .033 | .047 | .011 |
| American Indian or Alaska Native | .010 | .007 | .006 | .017 |
| Native Hawaiian or Pacific Islander | .001 | .001 | .001 | .001 |
| Female | .508 | .508 | .527 | .498 |
| Never Economically Disadvantaged (9th-12th grade) | .578 | .642 | .417 | .590 |
| Sometimes Economically Disadvantaged (9th-12th) grade) | .422 | .358 | .583 | .410 |
| Persistently Economically Disadvantaged (9th-12th) grade) | .23 | .186 | .346 | .219 |
| ACT Composite Score | 19.8 | 20.2 | 18.7 | 19.9 |
| College Choice-Set | | | | |
| med distance to nearest institution (miles) | 5.7 | 4.6 | 3.1 | 11.6 |
| med distance to nearest 2-year public (miles) | 9.5 | 8.2 | 5.9 | 16.2 |
| med distance to nearest 4-year public (miles) | 13.3 | 11.0 | 8.3 | 24.2 |
| Avg. Number Degree-Granting Institutions within CZ | 21.1 | 27.3 | 26.0 | 11.6 |
| Avg. Number Public Institutions within CZ | 5.9 | 7.2 | 7.1 | 3.8 |
| Avg. Number Public 4-years within CZ | 2.0 | 2.4 | 2.4 | 1.3 |
| School Characteristics | | | | |
| % Free/Reduced-price lunch eligible | 38.7% | 32.9% | 52.3% | 37.7% |
| Dropout Rate | 5.9% | 5.2% | 8.8% | 5.1% |
| Number of Students (in 9th grade cohort) | 244.3 | 314.3 | 260.6 | 158.2 |
| Block-Group Characteristics | | | | |
| % with at least a BA | 26.6% | 31.2% | 26.3% | 21.6% |
| Unemployment rate | 12.5% | 11.4% | 17% | 11.2% |
| Proportion housing units owner occcupied | .698 | .742 | .595 | .707 |
| med HH Income | 58683.5 | 66915.5 | 51045.9 | 53731.5 |
| Postsecondary Educational Outcomes | | | | |
| College enrollment | .659 | .694 | .635 | .634 |
| 4-Year College Enrollment | .408 | .438 | .379 | .392 |
| Highly competitive+ college enrollment | .043 | .049 | .054 | .030 |
| Bachelor's degree (within 6 years expected HS graduation) | .289 | .329 | .250 | .266 |
| N Students | 406,700 | 168,897 | 84,519 | 153,284 |
| N Students (with no missing data) | 362,100 | 153,170 | 69,979 | 138,951 |

*Notes:* Population includes high school graduates, graduating between 2010 and 2013. Statistics displayed are means unless otherwise noted. "CZ" refers to the commuting zone of the student's home county (U.S. Department of Agriculture 2023). The total number of students are included in the descriptive statistics. The sample with no missing data is used in the regression analyses.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023); U.S. Census Bureau (2023a).

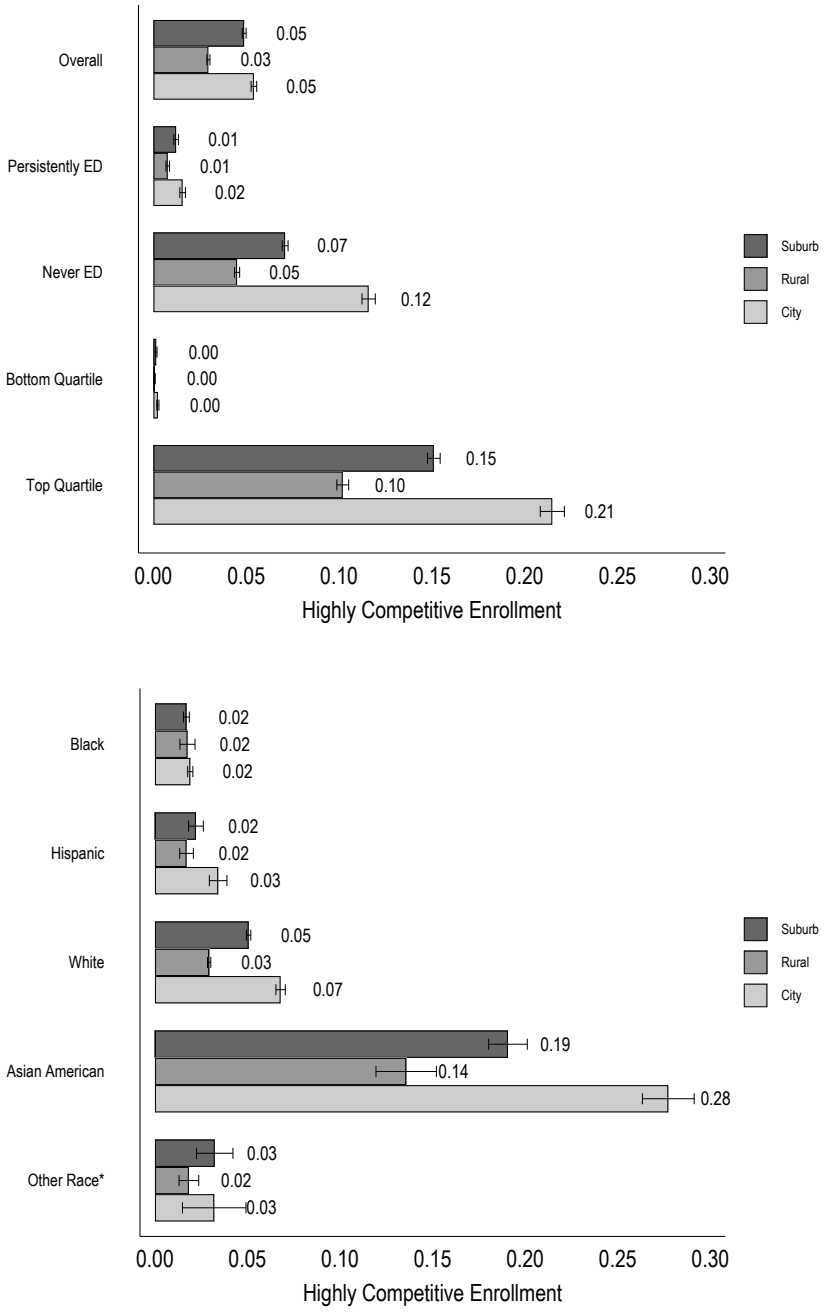
Panel A. Enrollment at a Four-Year Institution



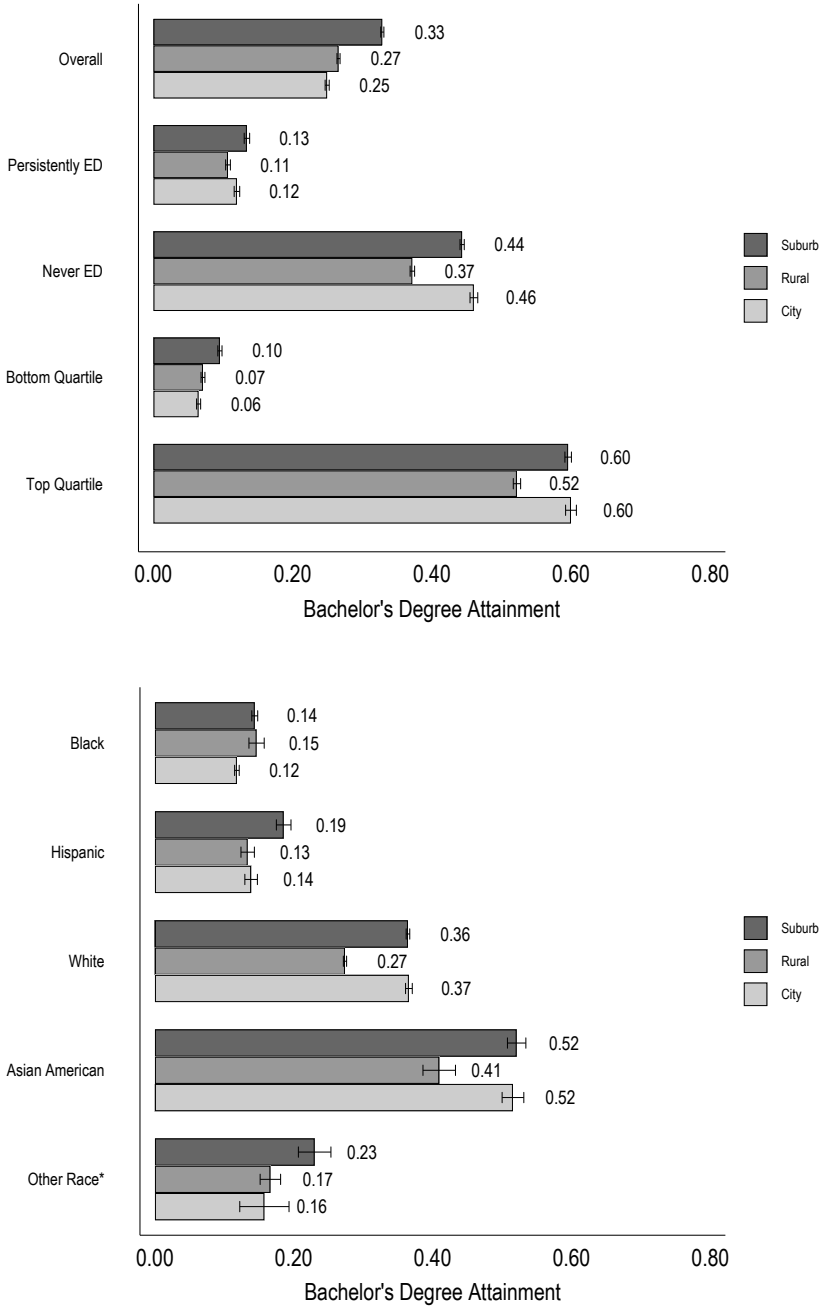

Appendix Figure C.2:
Heterogeneity in College Enrollment and Completion across Urbanicity for High School Graduates

Panel B. Enrollment at a Highly Competitive+ Institution




Appendix Figure C.2:
Heterogeneity in College Enrollment and Completion across Urbanicity for High School Graduates (cont.)

Panel C. Bachelor's Degree Completion




Appendix Figure C.2:
Heterogeneity in College Enrollment and Completion across Urbanicity for High School Graduates (cont.)

*Notes:* Rates calculated for Michigan public high school graduates (graduating between 2010-2013). Enrollment rates calculated in the fall following high school graduation. Bachelor's degree attainment is measured in the spring of the 6th year following high school graduation.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a)

Appendix Table C.2:
Regression Between Urbanicity and College Attainment Outcomes with Sequential Covariate Additions

| | Panel A. Enroll Four-Year | | | Panel B. Enroll Highly Selective+ | | | Panel C. BA Completion | | |
|---|---|---|---|---|---|---|---|---|---|
| | City Coefficient | Rural Coefficient | Rural - City Coefficient | City Coefficient | Rural Coefficient | Rural - City Coefficient | City Coefficient | Rural Coefficient | Rural - City Coefficient |
| Unadjusted | -0.037 | -0.051 | -0.014 | 0.010 | -0.021 | -0.031 | -0.064 | -0.069 | -0.005 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Race | -0.014 | -0.056 | -0.042 | 0.018 | -0.021 | -0.039 | -0.005 | -0.090 | -0.084 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Economic Circumstances | 0.007 | -0.033 | -0.040 | 0.023 | -0.016 | -0.039 | 0.018 | -0.064 | -0.082 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Gender | 0.006 | -0.032 | -0.038 | 0.023 | -0.016 | -0.039 | 0.017 | -0.064 | -0.081 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Academic Preparation | 0.010 | -0.012 | -0.021 | 0.024 | -0.011 | -0.035 | 0.020 | -0.047 | -0.066 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + Postsecondary Choice-Set | 0.018 | -0.010 | -0.028 | 0.022 | -0.006 | -0.028 | 0.021 | -0.031 | -0.052 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| + School Composition | 0.028 | -0.006 | -0.034 | 0.029 | -0.006 | -0.035 | 0.043 | -0.017 | -0.059 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.003) |
| + Community Composition | 0.014 | 0.005 | -0.009 | 0.019 | 0.001 | -0.018 | 0.028 | -0.005 | -0.032 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.003) |
| Just School Composition | 0.058 | -0.014 | -0.072 | 0.041 | -0.011 | -0.052 | 0.056 | -0.014 | -0.070 |
| | (0.002) | (0.002) | (0.003) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| Just Community Composition | -0.001 | 0.019 | 0.020 | 0.021 | 0.007 | -0.013 | -0.009 | 0.007 | 0.016 |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) |
| Suburb Mean | [0.461] | | | [0.052] | | | [0.349] | | |
| N | 362100 | | | 362100 | | | 362100 | | |

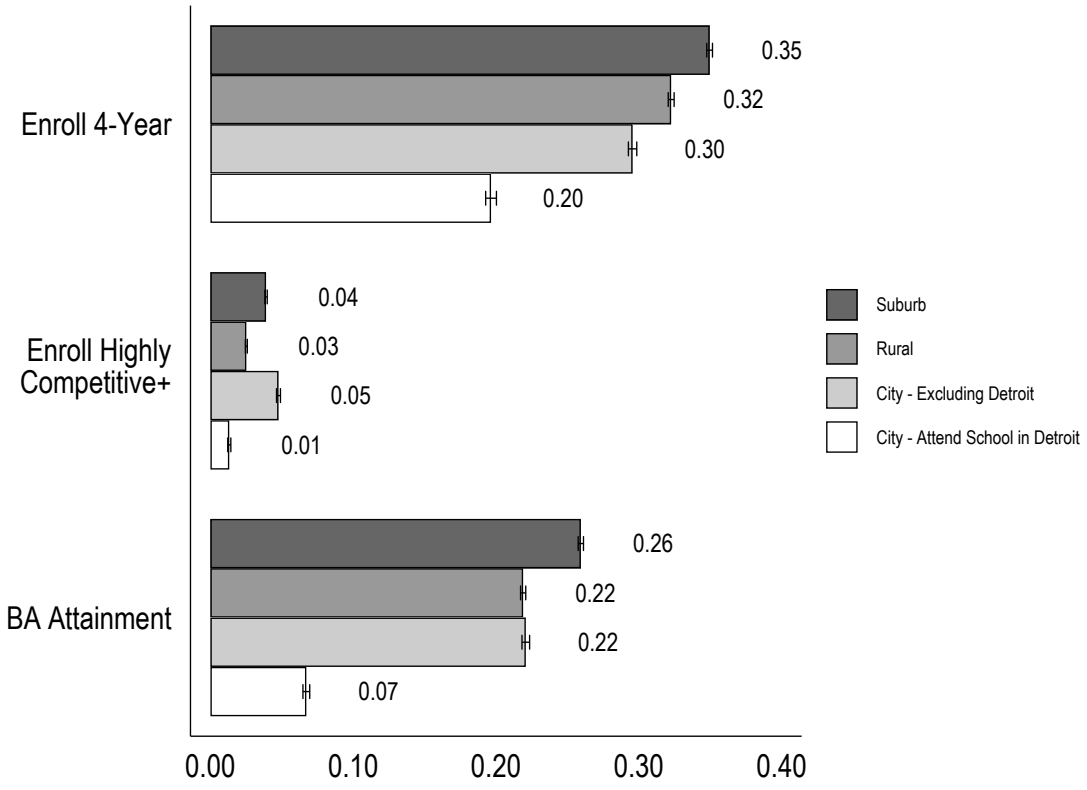
*Notes:* Results based on sequential linear probability regression models, where the binary postsecondary outcome is regressed on urbanicity indicator variables (suburb left out as a reference category). Population includes high school graduates from 2010-2013. Covariates are added sequentially, and the coefficients reported are from the urbanicity indicator in each of the sequential models. Only observations without missing data included.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023); U.S. Census Bureau (2023a).

## C.2 Are the city college going rates different for the city of Detroit and other Michigan cities?

Appendix Table C.3:
Student Characteristics, City Split into non-Detroit and Detroit Schools

| | Suburb | Rural | City - excl. Detroit schools | Attend school in Detroit |
|---|---|---|---|---|
| Student Characteristics | | | | |
| Black | 0.193 | 0.036 | 0.311 | 0.906 |
| White | 0.735 | 0.896 | 0.544 | 0.025 |
| Hispanic | 0.035 | 0.037 | 0.089 | 0.058 |
| Asian American | 0.028 | 0.009 | 0.048 | 0.007 |
| American Indian, Alaska Native, Native Hawaiian or Pacific Islander | * | * | * | * |
| Never ED (7th-9th grade) | 0.607 | 0.571 | 0.444 | 0.089 |
| Persistently ED (7th-9th grade) | 0.249 | 0.279 | 0.402 | 0.628 |
| Top Quartile 8th Grade Math Score | 0.275 | 0.259 | 0.239 | 0.059 |
| Bottom Quartile 8th Grade Math Score | 0.233 | 0.211 | 0.306 | 0.523 |
| N | 214,819 | 197,959 | 92,957 | 44,620 |

*Notes:* Population includes 9th grade cohorts 2007-2010. Detroit schools separated out from other cities based on having Detroit zip codes. Students who live in Detroit but attend school in suburban or rural places are included in the suburb or rural category, not the "Detroit" category.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a).




Appendix Figure C.3:
College Attendance and Completion, City Split into non-Detroit and Detroit Schools

*Notes:* Enrollment rates calculated in the fall following expected high school graduation. Bachelor's degree attainment is measured in the spring of the 6th year following expected high school graduation. Population includes 9th grade cohorts 2007-2010. Detroit schools separated out from other cities based on having Detroit zip codes.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a).

## C.3 Decomposition Analysis

To expand on the simple regression analysis, I evaluate the contributions of each factor—individual demographics, academic preparation, postsecondary choice set, school composition, community composition—to student geographic inequality in postsecondary outcomes. I use Oaxaca-Binder decomposition (Oaxaca, 1973; Blinder, 1973), a more comprehensive version of a method first introduced by Evelyn Kitagawa in 1955 (Kitagawa, 1955), to evaluate the relative contribution of geographic differences in student characteristics, postsecondary choice sets, school composition, and community composition to each geographic gap in postsecondary attainment: rural-suburb and city-suburb. This analysis allows me to describe the proportion of each of these gaps that can be explained by differences in observed characteristics, and how much is unexplained resulting in differences in the ways these characteristics operate.

All decompositions are estimated using the linear specification, and I report the decomposition results both with the coefficients and the proportion of the explained variation that coefficient represents. Ultimately, the decomposition results further confirm the findings of the sequential regression analysis: geographic differences in postsecondary educational attainment can be explained entirely by variation in the composition of these places rather than differences in the way student, school, and community characteristics operate in these places. That is, nearly all of the geographic gaps can be "explained" by differences in their composition. We saw this in the regression analysis, when including each of the covariates resulted in the removal (and in many cases, reversal) of the gaps. The decomposition results just confirm these findings.

### C.3.1 Decomposing Rural-Suburb Differences in Postsecondary Education Outcomes

Panel A of Table E1 shows the contribution of student demographics, academic preparation, college choice sets, and school and community characteristics to the gap between rural and suburban students in college attendance. Differences in the composition of race and economic disadvantage

among rural students compared with suburban students account for nearly half of the difference between rural and suburban student four-year college attendance, but account for less of highly selective college attendance (0.229) and BA completion (0.166). Community characteristics account for the largest proportion of the gap in all three outcomes (between 0.854 and 1.148). Community characteristics include block-group BA completion rate, income, unemployment rate, and the percentage of housing units that are owner occupied. As a reminder, Table 4.2 shows that rural and suburban communities have very different compositions. Specifically, rural communities have lower rates of bachelor's degree attainment than suburban communities (21 percent compared with 29 percent), as well as lower median household incomes ($53,000 compared with $63,000). In particular, lower levels of community education is positively associated with lower rates of college attendance and completion.

Finally, the choice sets for rural students as well as school composition contribute differently depending on the outcome considered. For four-year college attendance, both choice sets and school composition mitigate some of this gap: actually accounting for a reduction in the rural-suburb gap of 1.9 percentage-points and 0.6 percentage-points, respectively. For highly selective college attendance, school characteristics similarly mitigate the gap, reducing the gap by 0.6 percentage-points; however, student choice-sets contribute a substantial proportion (0.218) of the gap between rural and suburban students in highly selective college attendance. Finally, school characteristics contribute a small proportion (0.088) of the gap in BA completion, while college choice sets mitigate a small portion of the gap, reducing it by 0.8 percentage-points. Ultimately, community composition is the strongest contributor to the lower college attendance and completion outcomes among rural students compared with suburban students, and school and college choice sets have varying impacts depending on the outcome of interest.

### C.3.2 Decomposing City-Suburb Differences in Postsecondary Education Outcomes

Panel B of Table 2 conducts a similar exercise, decomposing the college attendance and completion gaps between city and suburban students. City students are 9 percentage-points less likely to attend a four-year college, half a percentage point less likely to attend a highly selective college, and 10 percentage-points less likely to graduate with a BA after six years. Academic preparation, as measured by 8th grade math scores, contributes the largest proportion of the explained difference between city and suburban students in four-year enrollment (0.574), highly selective enrollment (1.109), and BA completion (0.384). Community characteristics and economic disadvantage also contribute large proportions of the explained gap in each outcome. For four-year college enrollment and highly selective college enrollment, the racial compositions of cities compared to suburbs mitigate the gap, reducing the gap in four-year enrollment by 3 percentage-points and in highly selective college enrollment by half a percentage point. College choice sets contribute little to either four-year enrollment or BA completion, but slightly reduce the city-suburban gap in highly selective college attendance (contributing -0.111 of the explained difference). Finally, school characteristics matter little for four-year attendance and BA completion but do seem to reduce the city-suburban gap in highly selective college attendance by half a percentage point.

Comparing across Panels A and B, we see that community composition, race, and economic disadvantage matter a lot for rural students, all contributing substantially to the gaps in four-year college enrollment, highly selective college enrollment and BA completion. College choice sets seem to operate in opposite directions: while choice sets contribute a substantial proportion of the gap between rural and suburban students in highly selective college attendance (0.218), the contribution of choice sets to the city-suburban gap in highly selective college attendance is actually negative—that is, differences in college choice sets between city and suburban students actually reduces the gap in highly selective college attendance. Finally, school characteristics seem to explain little of the gap, or actually reduce the gap, between both rural and suburban students as well as the gap between city and suburban students. Notably, for each of these outcomes, the gaps are

more than explained by differences in characteristics, rather than differences in the coefficients. Similar to what we saw with the regression analysis presented in Table 3, this suggests that city-suburb gaps in postsecondary attainment are driven by differences in the characteristics in these places, rather than how these characteristics are operating. That is, due differences in the racial, economic, and school composition in these places; rather than how much each of these things matters by place.

### C.3.3 Discussion

The decomposition results reveal differences in the contributions to college attainment inequality for students in different geographic contexts. That is, the composition of economic disadvantage in cities compared to suburbs and rural areas contributes a considerable amount to these college attainment gaps. This raises important questions about whether a more dynamic measure of economic disadvantage may have revealed even starker patterns, given the racial differences in experiences of persistent disadvantage, particularly in childhood (Michelmore and Rich, 2022), that may be missed in this relatively limited measure of economic disadvantage.

While economic disadvantage and academic preparation seem to contribute the most to the city-suburb gap, accounting for community characteristics reverses the rural-suburb gap in college attainment. Similarly, community characteristics can explain a large portion of the rural-suburb gap in college attainment across outcomes. In fact, for four-year college attendance they more than account for the full gap between suburban and rural students. This aligns with what we know about college-going and college-expectation setting in rural communities and the importance of that for student postsecondary decision making. Specifically, that rural students' lower college attainment rates can be attributed, in part, to lower parental expectation for college attainment and lower community attainment rates (Byun et al., 2012). While community composition seems to matter less in the context of relative disadvantage for students in cities, it is possible that I have not accounted for the factors that matter most in cities: the complexity of economic disadvantage and housing instability that may exist in cities and contribute to overall disadvantage in college

attainment. Future analysis should consider more specific analyses that may better tease out the differences between school and community.

## C.4 Using Census Blocks for Student Location

Census blocks are constructed based on boundaries such as physical boundaries (e.g. roads, rivers, railroad tracks) as well as administrative boundaries (e.g. towns lines, county limits), rather than population size. Census blocks are the smallest geographic unit that the Census Bureau will tabulate data and represent the smallest geographic unit that I am able to identify in the administrative education data. While urban census blocks often mirror street blocks: one census block may be equal to one city block, rural and suburban census blocks may cover a larger area. While this difference is not easy to quantify, I provide maps for census blocks in six counties across the state: three "urban" counties (Wayne, Washtenaw, and Kalamazoo) and three "rural" counties (Antrim, Marquette, and Gogebic). Figure 1 shows us where each of these counties are in the state of Michigan. Figure 2 zooms in on each county and the block boundaries. For a clearer example of this, in Washtenaw County (area 723 square miles) there are 6541 blocks; compared with Antrim County (area 602 square miles) with 2423 blocks. In Wayne and Kalamazoo County, the number of blocks is even greater than those in Washtenaw. While it is clear from the maps that the census blocks in Wayne County are much smaller in area than the blocks in the rural counties in particular, the geographic regions marked by blocks in the rural counties are still quite small. Due to this disparity, distance measures should be interpreted with caution.

Appendix Table C.4:
Results from Separate Oaxaca-Blinder Decompositions of Differences in College Outcomes by Urbanicity

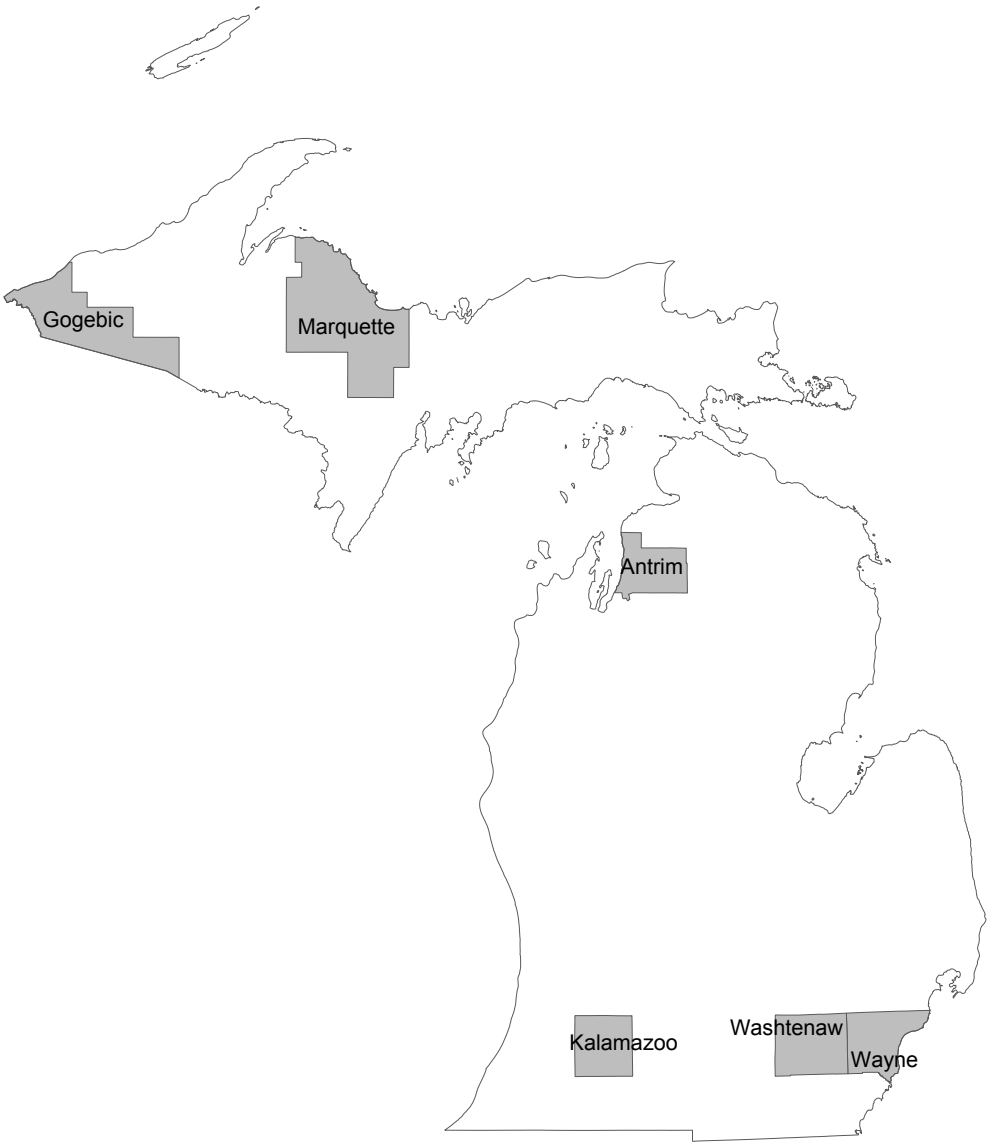
Panel A: Decomposing Suburb - Rural Difference

| | Enroll 4-year Institution | | Enroll Highly Competitive+ Institution | | Awarded BA within 6 years of exp. HS Grad | |
|---|---|---|---|---|---|---|
| | Coeff. | | Coeff. | | Coeff. | |
| Suburb Mean | 0.359 | | 0.042 | | 0.269 | |
| Rural Mean | 0.333 | | 0.025 | | 0.225 | |
| Difference | 0.026 | | 0.017 | | 0.044 | |
| | Coeff. | Prop. Of Explained | Coeff. | Prop. Of Explained | Coeff. | Prop. Of Explained |
| Total Explained | 0.030 | | 0.017 | | 0.042 | |
| Race | 0.013 | 0.438 | 0.004 | 0.226 | 0.003 | 0.060 |
| Gender | 0.000 | 0.014 | 0.000 | 0.002 | 0.000 | 0.009 |
| Economic Disadvantage | 0.005 | 0.151 | 0.000 | 0.003 | 0.004 | 0.106 |
| Academic Preparation | 0.003 | 0.091 | 0.001 | 0.044 | 0.002 | 0.053 |
| College Choice Set | -0.019 | -0.646 | 0.004 | 0.218 | -0.008 | -0.188 |
| School Characteristics | -0.006 | -0.196 | -0.006 | -0.346 | 0.004 | 0.088 |
| Community Characteristics | 0.034 | 1.148 | 0.015 | 0.854 | 0.037 | 0.872 |

Panel B: Decomposing Suburb - City Difference

| | Enroll 4-year Institution | | Enroll Highly Competitive+ Institution | | Awarded BA within 6 years of exp. HS Grad | |
|---|---|---|---|---|---|---|
| | Coeff. | | Coeff. | | Coeff. | |
| Suburb Mean | 0.359 | | 0.042 | | 0.269 | |
| City Mean | 0.268 | | 0.035 | | 0.168 | |
| Difference | 0.091 | | 0.006 | | 0.101 | |
| | Coeff. | Prop. Of Explained | Coeff. | Prop. Of Explained | Coeff. | Prop. Of Explained |
| Total Explained | 0.104 | | 0.018 | | 0.120 | |
| Race | -0.028 | -0.274 | -0.006 | -0.344 | 0.002 | 0.018 |
| Gender | -0.001 | -0.012 | 0.000 | -0.006 | -0.001 | -0.009 |
| Economic Disadvantage | 0.035 | 0.339 | 0.001 | 0.050 | 0.033 | 0.272 |
| Academic Preparation | 0.060 | 0.574 | 0.020 | 1.109 | 0.046 | 0.384 |
| College Choice Set | 0.003 | 0.030 | -0.002 | -0.111 | 0.000 | -0.001 |
| School Characteristics | 0.007 | 0.069 | -0.004 | -0.235 | 0.008 | 0.064 |
| Community Characteristics | 0.028 | 0.273 | 0.010 | 0.538 | 0.033 | 0.272 |

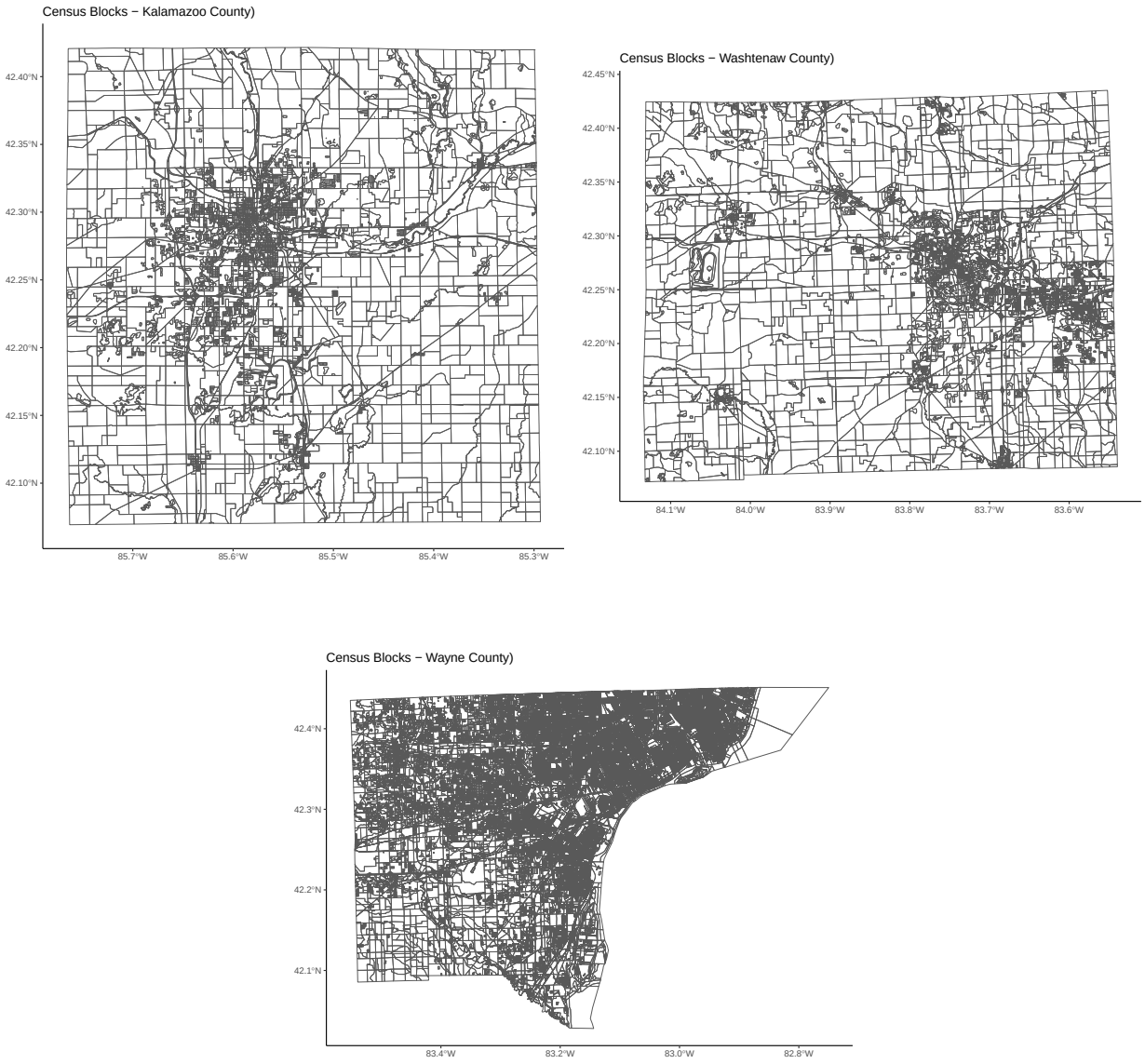
*Notes:* Results based on a linear specification of a Oaxaca-Binder decomposition. Decomposition run in three separate regressions: rural-suburb, city-suburb, city-rural. Population includes 9th grade cohorts from 2007-2010.
*Source:* Michigan's Center for Educational Performance and Information (2023b,a); U.S. Department of Education's National Center for Education Statistics (2023); U.S. Census Bureau (2023a).




Appendix Figure C.4:
Michigan Block Size Example Counties

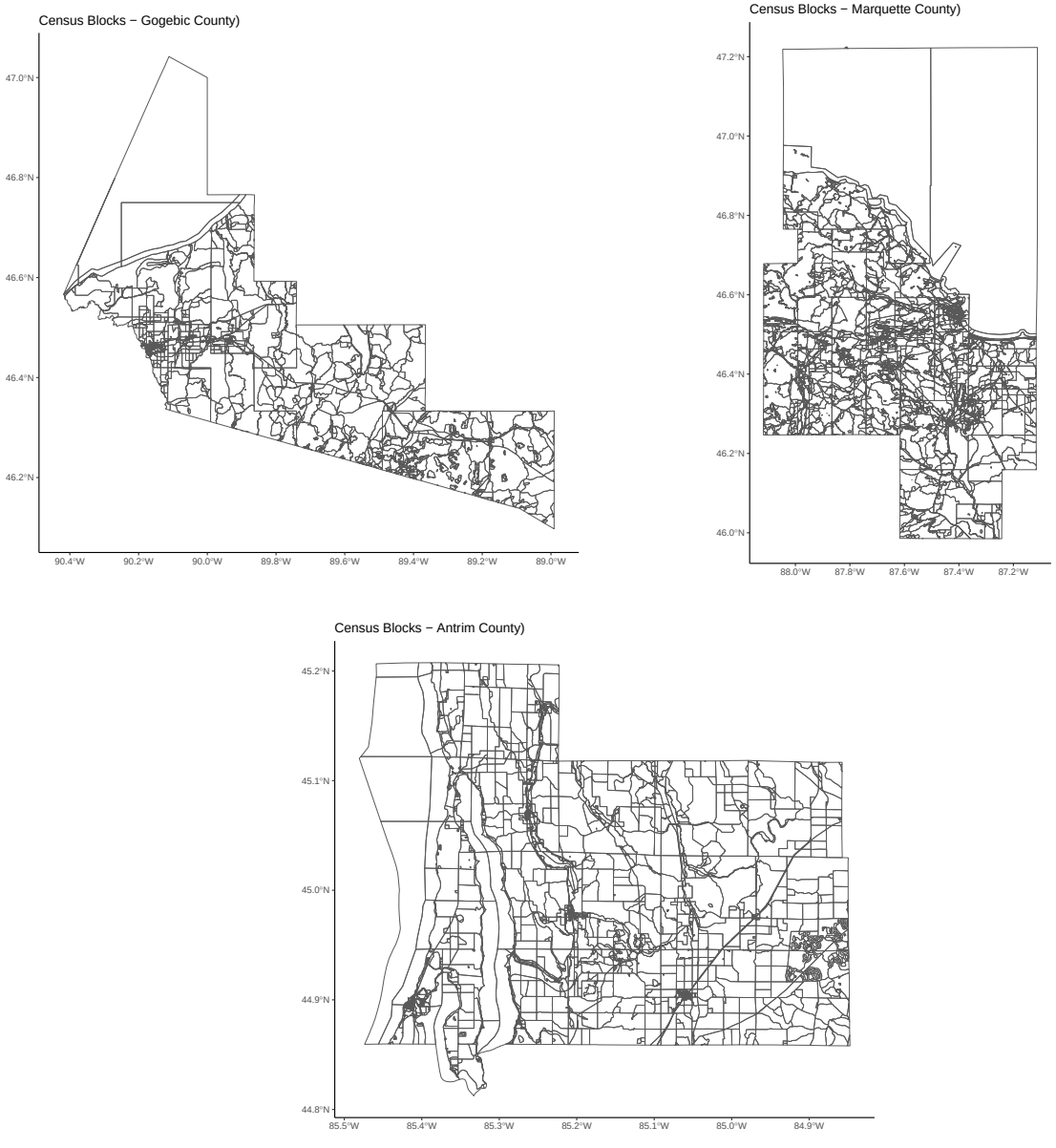
*Source:* U.S. Census Bureau (2023b).

Panel A. Urban Counties




Appendix Figure C.5:
Census Block Boundaries for Six Counties

Panel B. Rural Counties




Appendix Figure C.5:
Census Block Boundaries for Six Counties (cont.)

*Source:* U.S. Census Bureau (2023b)

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