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College Attendance among Low-Income Youth: Explaining Differences across Wisconsin High Schools

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Bolstering low-income students' postsecondary participation is important to remediate these students' disadvantages and to improve society's overall level of education. Recent research has demonstrated that secondary schools vary considerably in their tendencies to send students to postsecondary education, but existing research has not systematically identified the school characteristics that explain this variation. Identifying these characteristics can help improve low-income students' postsecondary outcomes. We identify relevant characteristics using population-level data from Wisconsin, a mid-size state in the United States. We first show that Wisconsin's income-based disparities in postsecondary participation are wide, even net of academic achievement. Next, we show that several geographic characteristics of schools help explain between-secondary school variation in low-income students' postsecondary outcomes. Finally, we test whether a dense set of school organisational features explain any remaining variation. We find that these features explain virtually no variation in secondary schools' tendencies to send low-income students to postsecondary education.

Keywords: college attendance, educational inequality, geography, low-income students, school effects

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Obiskovanje srednjih šol med mladimi z nizkimi dohodki: pojasnjevanje razlik med srednjimi šolami v Wisconsinu

Christian Michael Smith in Noah Hirschl

Spodbujanje udeležbe dijakov z nizkimi dohodki v posekundarnem izobraževanju je pomembno za odpravo pomanjkljivosti teh dijakov in izboljšanje splošne ravni izobrazbe v družbi. Nedavne raziskave so pokazale, da se srednje šole precej razlikujejo v svojih težnjah po vključevanju dijakov v posekundarno izobraževanje, a obstoječe raziskave niso sistematično opredelile značilnosti šol, ki bi pojasnile te razlike. Opredelitev teh značilnosti lahko pomaga izboljšati dosežke dijakov z nizkimi dohodki v posekundarnem izobraževanju. Ustrezne značilnosti smo opredelili s podatki na ravni prebivalstva iz Wisconsina, srednje velike zvezne države v Združenih državah Amerike. Najprej smo pokazali, da so razlike med učenci v Wisconsinu glede na dohodek pri udeležbi v posekundarnem izobraževanju velike, tudi če ne upoštevamo učnih dosežkov. Nato smo pokazali, da več geografskih značilnosti šol pomaga pojasniti razlike med srednjimi šolami v rezultatih učencev z nizkimi dohodki v posekundarnem izobraževanju. Nazadnje smo preverili, ali gost nabor organizacijskih značilnosti šol pojasnjuje preostale razlike. Ugotovili smo, da te značilnosti ne pojasnjujejo skoraj nobenih razlik v težnjah srednjih šol, da bi dijake z nizkimi dohodki vključile v posekundarno izobraževanje.

Ključne besede: obiskovanje srednjih šol, neenakost v izobraževanju, geografija, učenci z nizkimi dohodki, učinki šole

Introduction

In the U.S. at large, low-income youth are far less likely to participate in postsecondary education than their more economically advantaged counterparts. A low-income individual is less likely to attend postsecondary education (*college* in the U.S.), especially a baccalaureate college,[3] than even economically advantaged individuals with the same level of academic achievement (Belley & Lochner, 2007). At minimum, this disparity is important because baccalaureate college attendance is associated with a hefty wage premium. The value of attending a baccalaureate college for the typical secondary school graduate is estimated to be between $85,000 and $300,000 over the life course compared to not attending, even adjusting for the increasing costs of attendance (Webber, 2016). Disparities in baccalaureate college attendance help keep society stratified, with low-income youth becoming low-income adults and high-income youth becoming high-income adults. Postsecondary participation confers other private benefits such as health (Cutler & Lleras-Muney, 2006) and job satisfaction (Baum et al., 2013), further suggesting that baccalaureate college attendance disparities help stratify desired outcomes based on one's socioeconomic origins. Moreover, given that increases in statewide educational attainment bring *public* rewards like increased tax revenue and civic involvement (Baum et al., 2013), all of society stands to benefit when more low-income youth participate in postsecondary education.

A wealth of work has shed light on the important role of primary and secondary schools in boosting low-income students' test scores, but only recently have scholars begun to study the contribution of secondary schools (*high schools* in the U.S.) to youths' postsecondary outcomes (Jennings et al., 2015). Using data from Massachusetts and Texas, Jennings and colleagues argue that differences between schools are even more important for college attendance than they are for improving standardised test scores. While their study demonstrates that high schools vary in the extent to which they send students to college, knowledge is sparse on what specific school-level characteristics explain this variation, especially for low-income students. Existing U.S. studies use small-scale data or focus on a single school characteristic (e.g., Hill, 2008; Turley, 2009). To date, the most thorough evidence in the U.S. comes from Engberg and Wolniak (2010), who study

3 Throughout, *baccalaureate college* refers to an institution of postsecondary education that confers bachelor's degrees. Bachelor's degree-granting programmes in the U.S. are typically designed to take four years to complete and are required for someone to enter graduate and professional programmes that grant master's and doctoral degrees. In contrast, associate's degree-granting programmes in the U.S. are typically designed to take two years to complete and do not open doors to graduate or professional degree programmes. We use *two-year college* to denote institutions that only grant associate's degrees and vocational certificates. Compared to baccalaureate colleges, two-year colleges have appreciably lower rates of return in the U.S.

high school-level predictors of postsecondary participation, yielding particularly rich findings related to school composition. We build on their study by examining the role of previously unmeasured geographic context characteristics as well as new school organisational features that administrative data allow one to measure.

We are centrally interested in what explains variation in high schools' effects on low-income students' baccalaureate college attendance. To determine which types of schools are more successful in sending low-income students to baccalaureate colleges, our study uses a relatively dense set of student-level and school-level characteristics. We draw these data from the population of Wisconsin public school students who entered the ninth grade for the first time between the 2006/07 and 2011/12 school years. Our research questions are as follows:

1. How large are economic disparities in baccalaureate college attendance in Wisconsin?
2. How much variation is there between high schools in the share of their low-income students who attend baccalaureate colleges, controlling for student characteristics?
3. Which high school characteristics explain this between-school variation?

School effects research: Canon and recent advances

The *Equality of Educational Opportunity* study (Coleman et al., 1966) was the springboard for decades of sociological inquiry into how much schools differ in their effectiveness, even inspiring a focus issue of this journal (Sardoč & Gaber, 2016). Coleman and his colleagues found that the majority of variance in academic achievement was found within rather than between schools, implying that factors outside school, such as students' racial and socioeconomic backgrounds, drove academic outcomes, leaving only a small amount of room for schools to move the needle. Using more sophisticated methods, more recent research has presented a comparatively sanguine picture of schools' capacities to boost student achievement, though students' individual characteristics are still responsible for more of the variance in academic achievement than are schools (Borman & Dowling, 2010; Bryk & Schneider, 2002).

Schools may differentially influence more than only academic achievement, though. Increasingly, education researchers are investigating schools' differential effects on adult outcomes like dropout rates, criminal activity, educational attainment and earnings. As a result, the field is learning that high schools can have large effects on non-achievement outcomes like postsecondary behaviour, while having relatively meagre effects on student's academic achievement. Cullen et al. (2006) study students in Chicago, Illinois and find that the high school one attends has a substantial impact on intentions to attend

college. Deming and colleagues (2014) study students in Charlotte, North Carolina and find that one's high school matters in determining whether one actually participates in postsecondary education. Research using national samples in the U.S. (Altonji & Mansfield, 2011; Rumberger & Palardy, 2005), national data in Wales (Taylor et al., 2018), and statewide databases in the U.S. (Jennings et al., 2015) has found variation across schools of similar magnitude. Jennings and colleagues (2015) go further to argue that the variance in school effects is larger for baccalaureate college attendance than for exam scores.

Factors that may explain school effects: Theory and evidence

While research has shown that where students attend school matters for whether they attend college, this new knowledge has generated a black box problem: in terms of *explaining* between-school variation in students' college outcomes, the field of education has tested only a sparse set of school characteristics. Knowing which school characteristics explain this variation is useful for identifying the best ways to boost students' college attendance. Below, we discuss several geographic and school organisational characteristics, reviewing theory and evidence on whether the characteristic should affect college attendance.

Geographic context

Education scholars are increasingly noting the role that geography plays in college attendance (Hillman, 2016; Turley, 2009), school effects (Geppert et al., 2012) and the intersection of the two (Hirschl & Smith, 2020). Geppert et al. (2012) advise researchers to consider how geographic inequalities might drive between-school inequalities in student outcomes. Below, we heed this advice by considering several geographic factors.

Distance to institutions of postsecondary education may be one geographic characteristic that helps explain between-school variation in students' college outcomes. In general, evidence suggests that nearby institutions pull students to attend. Thus, students close to baccalaureate colleges are more likely to attend a baccalaureate college (Turley, 2009) and students close to two-year colleges are less likely to attend a baccalaureate college because they have higher probabilities of attending two-year colleges instead (Alm & Winters, 2009). Although these associations may be spurious, studies exploiting new university openings in Canada (Frenette, 2009) and California (Lapid, 2017) suggest the relationships are causal. Theoretical explanations for a causal effect include the possibility that local colleges allow students to attend college more affordably and conveniently while remaining close to friends and family, and the possibility that local colleges instil a college-positive culture.

The local demographic composition of an area could also help explain between-school variation in students' college outcomes. Of particular importance may be the proportion of adults in the area who have bachelor's degrees, for which there is strong evidence of an effect on youths' later postsecondary outcomes (Tach et al., 2016). Theoretically, students growing up around many college-educated adults will likely have more college-educated role models who demonstrate a norm of postsecondary participation. Plausibly, these students will also have more sources of information about the process of applying to institutions, obtaining financial aid and choosing an institution.

Finally, rurality is important to consider. More often than urban and suburban areas, rural areas are characterised by low parental expectations for children's educational attainment (Roscigno & Crowley, 2001) and a predominance of blue-collar work that does not require bachelor's degrees (Roscigno et al., 2006). These factors likely decrease students' motivation to attend baccalaureate colleges. Empirical evidence confirms that rural students are disadvantaged with respect to postsecondary outcomes (Byun et al., 2012).

School organisational features

Beyond geographic context, school organisational features are important from a policy perspective because they are more manipulable than geography characteristics. Among these school organisational features are student-counsellor ratios. There are significant disparities across high schools in access to counsellors who can provide key college information and encouragement, particularly for students whose parents have little or no experience with postsecondary education (McDonough & Calderone, 2006; Wolniak & Engberg, 2007). Ethnographic accounts emphasise the extent to which school counsellors can succeed or fail in providing key information about deadlines and requirements (McDonough, 1997; Radford, 2013). Quantitative studies have found evidence that school personnel especially influence students from poor families or whose parents did not attend college (Bettinger et al., 2012; Castleman & Page, 2015; Engberg & Gilbert, 2014). These results suggest, but do not prove, that small student-counsellor ratios may improve students' college outcomes by allowing counsellors to focus their positive efforts on a smaller number of students.

Per-pupil school expenditures may also matter. While early studies cast doubt on the importance of school spending for students' educational outcomes (Coleman et al., 1966; Hanushek, 1989), more recent studies have shown significant effects of per-pupil spending on students' ultimate educational attainment. Johnson (2015) finds that students benefit from increased Title 1 funding, and Jackson, Johnson and Persico (2015) exploit decades of school finance reforms

to identify positive effects of increased school spending. Both studies find that the effects are greatest among students in poverty.

Rigorous coursework like Advanced Placement (AP) and International Baccalaureate (IB) classes may also help explain between-high school variation. Early work comparing public schools to private and Catholic schools emphasises the importance of high academic standards and broad access to college-track classes in explaining the differences in achievement and later baccalaureate college enrolment rates between sectors (Hoffer et al., 1985). Students who enrol in advanced classes are more likely to attend and succeed in postsecondary education (Long et al., 2012). Moreover, variation across high schools in the availability of high-level coursework like AP classes predicts attendance at both selective colleges and baccalaureate colleges generally (Klugman, 2012).

In the same vein, there is theoretical reason to believe that internally segregated high schools may discourage low-income students from attending baccalaureate colleges. If advanced coursework is beneficial, then it is not enough simply to offer these courses; low-income students must *take* the courses in order for them to benefit. Since low-income students are far less likely than higher-income students to take advanced courses, even among students with similar academic achievement (Conger et al., 2009), schools with more between-classroom economic segregation are probably schools where low-income students take these advanced courses especially rarely. In contrast, schools where low-income and high-income students occupy the same classrooms are probably schools where low-income students have equal opportunity to take advanced courses.

Method

Data

Our data come from Wisconsin, a medium-population state in the Midwestern region of the United States. Wisconsin is a valuable case for study because, while urban school districts have received disproportionate attention in research on school effectiveness for postsecondary outcomes, Wisconsin has many students in both rural areas and high-density metropolitan areas. Furthermore, Wisconsin is not only a typical state in terms of urban and rural population rates, but also in terms of median household income (Guzman, 2017) and average academic achievement (National Center for Education Statistics, 2019).

In this study, the main analytic set consists of Wisconsin public school students who entered ninth grade for the first time between the 2006/07 and 2011/12 school years, except for those whose eighth-grade test scores are missing (14% of

population),[4] plus those whose primary high school was one of the 67 schools with missing school-level data (1% of population). In total, the set consists of 352,421 students from 513 high schools. These schools are spread across 382 school districts, 329 of which have only one high school. Most of our analyses restrict to the subset of students (N = 153,760) we consider low-income, as defined later. The student-level data are made available to us by the Wisconsin Department of Public Instruction through the Statewide Longitudinal Data System, and they cover information about individual students as well as the schools they attend, including demographics, test scores and enrolment patterns.

We track high school graduates from Wisconsin into college using data from the National Student Clearinghouse. For every semester, the clearinghouse records the postsecondary institution where students enrol. These data cover between 93% and 97% of all national postsecondary enrolment over the period we study. The Department of Public Instruction conducts a data linkage twice per year – in March and November – for all students who graduate from a Wisconsin public high school, so it captures enrolment and degree attainment even long after students have graduated. We include enrolment in all public, private not-for-profit and private for-profit institutions in our study, and further distinguish between postsecondary institutions in two ways: two-year versus baccalaureate institutions, and, among baccalaureate institutions, less selective and highly selective, or elite, institutions. We define the latter group as being one of the 236 colleges rated "very competitive plus" or higher in Barron's Profiles of American Colleges (2008). We focus on the first college students attend at least half-time within two years of completing high school. This emphasis excludes dual enrolment of students taking college courses while in high school as well as transfers after the initial half-time college matriculation.[5] In this report, we focus mainly on the results for baccalaureate colleges generally but note results for elite colleges when they diverge from those for all baccalaureate colleges.

We employ a variety of student, school and district-level measures in our analysis. Student characteristics include race (white, black, Hispanic or other/multiple race), sex, the percentage of observed years the student was designated an English language learner, whether the student was ever recorded as having a disability, the student's total absences in eighth grade, whether the student was suspended in eighth grade, and the student's eighth-grade math and language arts

4 The majority – about 80% – of these missing students did not attend Wisconsin public middle schools in eighth grade and, according to our correspondence with the Department of Public Instruction, were likely enrolled in private schools.

5 We experimented with evaluating whether students ever attend a baccalaureate college and the results are substantively similar, probably because the rate of attendance does not rise very much when such students are included.

scores from the Wisconsin Knowledge and Concepts Examination (WKCE). We are restricted to measuring students' economic disadvantage using their receipt of free- or reduced-price lunch. Students are eligible for reduced-price lunch if their family income is at or below 185% of the U.S. federal poverty line, which in the 2015/16 school year was $44,863 of annual income for a family of four (U.S. Department of Agriculture, 2015). Families may qualify automatically because they are registered for other federal programmes such as the Supplemental Nutrition Assistance Program or they may apply for eligibility.

Among students who receive subsidised lunch, those who do so for more years tend to have lower family incomes and test scores (Michelmore & Dynarski, 2017). In our own data, we observe a large gradient in test scores and college attendance across students' years of measured disadvantage. Therefore, we measure economic disadvantage as the percentage of observed years that students receive subsidised lunch. We define *low-income* students as those who receive subsidised lunch for at least one year, and *middle/high income* students as those who never do. The former category comprises about 44% of ninth graders in Wisconsin. When we refer to *persistently disadvantaged* students, we mean students who were eligible for subsidised lunch in all of the observed years.

We also examine characteristics of schools and districts that may be associated with college outcomes. At the school level, we measure average enrolment across the study period, the racial/ethnic composition of students, the percentage of students eligible for subsidised lunch, the student-to-school counsellor ratio, the student-to-teacher ratio, the number of Advanced Placement or International Baccalaureate subjects offered, per-pupil educational expenditures, and whether the school is a charter. We additionally measure the segregation of economically disadvantaged students between classrooms (within schools) using the dissimilarity index.[6] We also use data from the American Community Survey aggregated at the school district level in the years 2011–2015, made available through the tabulations from the National Center for Education Statistics. The Center classifies districts' locale type using 12 categories based on population density and distance from urban centres, which we winnow to six: Milwaukee (the largest city), Madison (the second largest city), medium to small city, suburb, town, or rural. We also use these data to measure median household income and the percentages of adults 25 and older in each district who are employed and who hold a bachelor's degree or higher. Finally, we measure the distance between the high school and the nearest Wisconsin

6 In our case, the dissimilarity index can be interpreted as the percentage of students who would have to be moved across classrooms within a school to completely equalise classrooms with respect to free or reduced-price lunch status.

public two-year college, as well as the distance between the high school and the nearest of Wisconsin's bachelor's-granting public universities. There are 13 such universities, constituting the 4-year sector of the University of Wisconsin (UW) system; thus, we henceforth refer to these universities as *UW 4-year campuses*.

Analytic strategy

Public high schools serve student populations that differ on a variety of dimensions, and many of these differences are beyond the control of high schools themselves. For instance, a high school serving a population whose math achievement in middle school is lower than the state average will likely see fewer students attending college after graduation, but part of this difference will be attributable to events prior to high school. Thus, to estimate the effect of schools on students' postsecondary outcomes, we control for students' math and English standardised test scores in the eighth grade, race/ethnicity, sex, English learner status, disability status, absences, and suspensions in the eighth grade. Our strategy compares students who are similar in all of the ways we can observe prior to ninth grade, except that they attend different high schools. However, we probably do not observe other important student characteristics, and thus the results we present below should be interpreted in light of that fact.

We further distinguish different categories of school effects using a schema motivated by prior research (Jennings et al., 2015; Raudenbush & Willms, 1995). Going to one high school rather than another could affect students' college outcomes through two broad factors: the context of the school, including factors like the composition of the student body, the surrounding neighbourhood or the local economy; and the actual practices and organisational structure of the school, including elements like course offerings, teaching practices, counselling or leadership. Our estimates of the *total effect* of schools do not distinguish between these categories. An intuitive way to think about the total effect of the school is what a parent would be interested in knowing about when choosing a high school. Other estimates presented in the Results section, however, explore the measurable features of schools that may be of more interest to policymakers.

The model for estimating total school effects is a hierarchical linear model with student-level independent variables; interaction terms between race and the proportion of years eligible for free or reduced-price lunch, between eighth-grade English language arts score and the proportion of years eligible for free or reduced-price lunch, and between eighth-grade math score and the proportion of years eligible for free or reduced-price lunch, as well as a random intercept for each school. The student-level variables are those listed in the Data section above, with cubic transformations of the eighth-grade test

scores. The interaction terms are in place to capture how students' baccalaureate college attendance is less sensitive to their economic disadvantage when they are black and high-achieving. Each school-specific random intercept is an estimate of the total effect of the school on low-income students' baccalaureate college attendance. To reduce bias due to students' selection into different schools, this estimate is conditional on student-level characteristics. The estimate is not, however, conditional on any school-level characteristics, including those that the school cannot manipulate, such as its locale type. We therefore distinguish this total effect estimate from a value-added estimate, which measures how efficacious a school is net of factors outside its control.

The general model for estimating the effect of school-level characteristics is the same as the foregoing model, except that it adds the school- and district-level variables listed in the Data section. Continuous school- and district-level variables are z-transformed. Rather than estimate the effects of all school characteristics simultaneously in a model containing all school-level variables, we estimate the effect of each school characteristic with a unique specification that controls for only those variables we conceive of as potential confounders, not mediators, on the path to baccalaureate college attendance. Therefore, (a) we estimate the effect of each geographic context variable with a model controlling only for student-level variables; (b) we estimate the effect of each school composition variable with a model controlling only for student-level and geographic context variables; and (c) we estimate the effect of each school organisational feature with a model controlling for student-level, geographic context and school composition variables, but not controlling for other school organisational features. Our design does not exploit exogenous variation in any school-level characteristic, so we cautiously interpret results as only crude estimates of how school characteristics affect baccalaureate college attendance.

Results

Economic disparities in postsecondary education

Before analysing variation in school effects, we begin by describing economic disparities in postsecondary outcomes in Wisconsin. We argue that the disparities are wide and not entirely due to differences in academic achievement. Figures 1 and 2 show the educational outcomes of a single cohort of low-income and middle- to high-income students, respectively, who were ninth graders in Fall 2005. Of every 100 of these low-income ninth graders, 72 hold Wisconsin high school diplomas 11 years later, by Spring 2016 (Figure 1). Baccalaureate college entry and completion are both uncommon, with 19 of every 100

low-income ninth graders enrolling in a baccalaureate college and nine of every 100 holding bachelor's degrees or higher by Spring 2016. Low-income students were about as likely to enter 2-year colleges as they were baccalaureate colleges, but degree attainment is especially rare for those who start at 2-year colleges. Of the 18 in 100 who enter a 2-year college, one held a bachelor's degree by Spring 2016, and four held associate's degrees. An additional one of every 100 achieved an associate's degree through "reverse transfer" from a baccalaureate college to a 2-year college.

The state of affairs is drastically different for middle- and high-income students (Figure 2). In Fall 2005, of every 100 middle/high-income ninth graders, 92 held high school diplomas and 37 held bachelor's degrees by Spring 2016. Forty-seven entered a baccalaureate college, more than twice the frequency of low-income students who were in ninth grade in 2005. Almost four times the share of middle/high-income students earned bachelor's degrees by 2016 as low-income students. Whereas low-income individuals attended baccalaureate colleges and 2-year colleges at similar rates, middle/high-income students were more than twice as likely to attend a baccalaureate college as a 2-year college. When middle/high-income students did attend a 2-year college, they were more likely to attain degrees than were low-income 2-year college students.

Examining our main analytic sample of *all* public school students entering ninth grade in the period 2006–12, we find large unconditional inequality in baccalaureate college attendance. Persistently disadvantaged youth have a baccalaureate college attendance rate of 17%, versus 52% among those who were never economically disadvantaged.

Figure 1

Educational trajectories of low-income students a decade after they enter high school

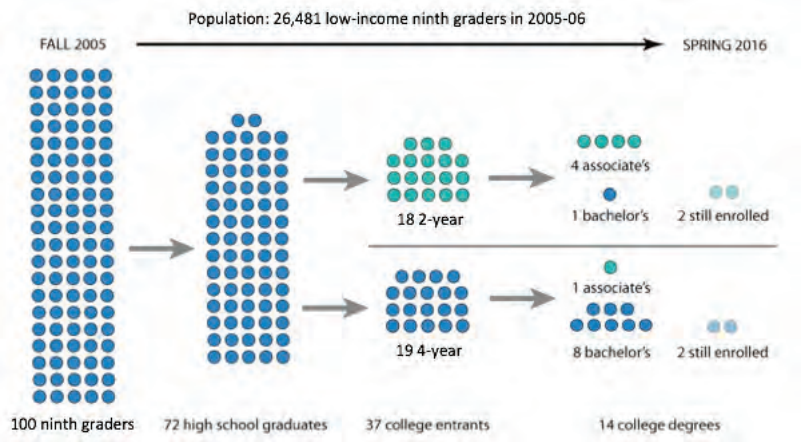
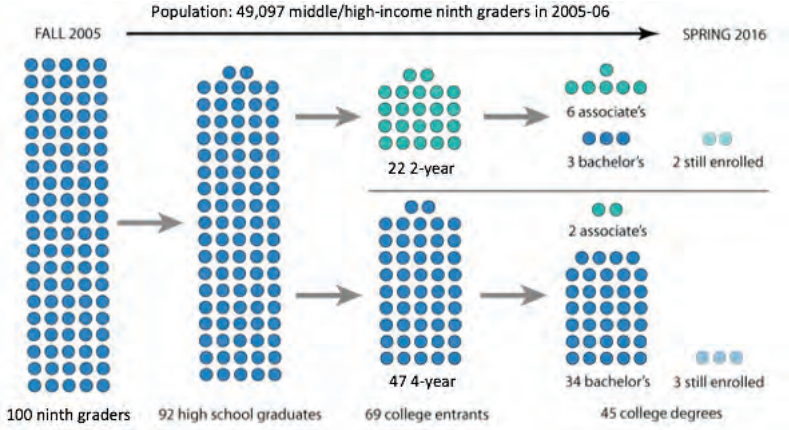


Figure 2

Educational trajectories of middle/high-income students a decade after they enter high school



Do disparities in academic achievement fully explain this gap, or do additional mechanisms come into play? To answer this question, we estimate a statistical model of baccalaureate college attendance that gives the association between economic disadvantage and baccalaureate college attendance while controlling for 12th-grade grade-point average (GPA) and 10th-grade math and language arts test scores.[7] Net of high school academic achievement, persistent economic disadvantage is still associated with a 12 percentage point drop in the probability of attending a baccalaureate college (full model output available upon request). Thus, academic achievement does not fully explain economic disparities in baccalaureate college attendance. While 12th-grade GPA and 10th-grade test scores do not fully capture a student's level of academic achievement, unmeasured aspects of achievement would need to be extremely predictive of baccalaureate college attendance to undermine the claim that economically disadvantaged and advantaged students of comparable achievement have unequal attendance rates.

Differences across Wisconsin High Schools

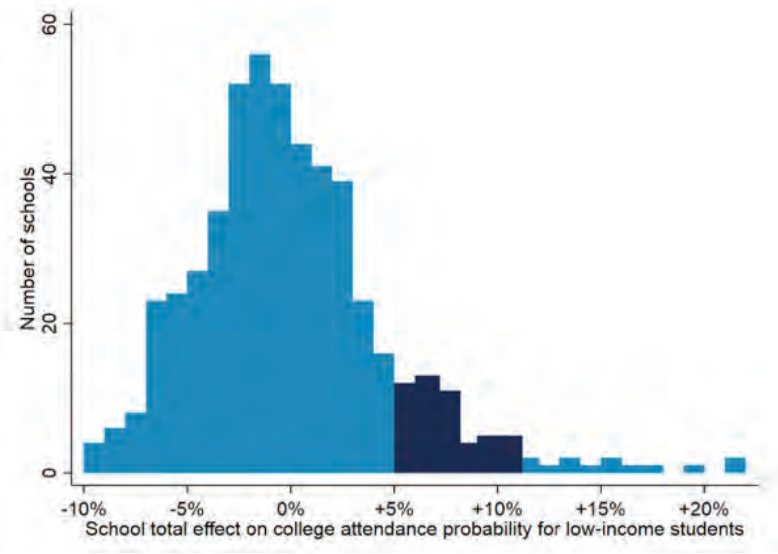
Having described the income gap in college attendance in Wisconsin, the next step in our analysis is to assess differences across high schools. Net of demographic characteristics of students and their levels of eighth-grade achievement,

7 Data on students' coursework and grades are available only in limited years. This analysis therefore consists only of students who finished 12th grade in the 2013/14 school year and only their senior-year grades.

how much do high schools vary in the share of their economically disadvantaged graduates they send on to baccalaureate colleges? Figure 3 plots the distribution of these conditional school differences relative to the average Wisconsin school. The least successful high schools reduce the chances their low-income graduates attend a baccalaureate college by an estimated 10 percentage points, net of demographic attributes and academic achievement in middle school. On the other hand, the most successful high schools add an estimated 20 percentage points to the chances that their low-income graduates will attend a baccalaureate college. Low-income students who attend high schools in the dark blue region of Figure 3 – the 68th through 95th percentiles of high school effectiveness – are conditionally 5 to 11 percentage points more likely to attend baccalaureate colleges within 2 years of graduating from high school compared to the average high school in the state, a substantial boost considering that the overall baccalaureate college attendance rate among low-income students is about 20%. We conclude that where one attends high school can make a substantial difference in the postsecondary trajectories of a low-income student in Wisconsin. In the following two sections, we examine the features of schools' local contexts and organisational features that are associated with better outcomes for low-income students.

Figure 3

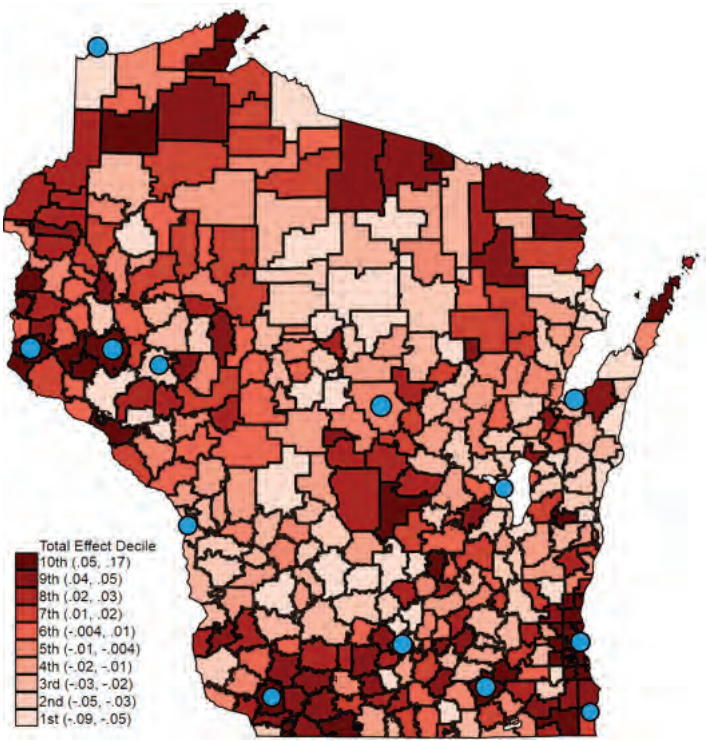
Variation in school total effects on baccalaureate college attendance



Note. Hierarchical linear model controls for eighth-grade test scores and other student-level pre-high school controls. Each school's total effect is estimated by its random intercept in this model. Sample includes all low-income ninth graders entering high school for the first time from 2006 to 2011 (N = 153,760).

Figure 4

Map of district total effects on baccalaureate college attendance



Note. Total effects for districts generated from a model equivalent to the total effects for schools using districts as the cluster variable. Model controls for eighth-grade test scores and other pre-high school controls. Sample includes all low-income ninth graders entering high school for the first time from 2006 to 2011 (N = 153,760). Blue dots represent the locations of UW 4-year campuses.

Local geography and context

Broad patterns and rurality

Geography appears to be important. Much of the variation that we see across schools also manifests across districts with distinct patterning. To visualise variation in effects of schools across place, we use districts as the unit of analysis instead of schools and show the result as a map in Figure 4. With students' eighth-grade characteristics held constant, the districts with the largest positive influence, shaded the darkest, are in Milwaukee suburbs and Milwaukee itself (the largest city in Wisconsin), some districts surrounding the small cities of Madison and Green Bay, districts in north-western Wisconsin near

Minneapolis (the largest city in the state of Minnesota), and some districts in the southwest. In general, Wisconsin's more rural areas see less baccalaureate college attendance than more densely populated areas. On average, a low-income student in Milwaukee is nearly 6 percentage points more likely to attend a baccalaureate college compared to an otherwise similar student living in a rural district. A student in a district classified as suburban is about 3 percentage points more likely to attend compared to a rural student.

Distance to institutions of postsecondary education

The parts of the state with the highest conditional rates of baccalaureate college attendance also tend to be near UW 4-year campuses. To investigate the role of distance to postsecondary institutions, we measure the distances from students' high schools to the nearest UW 4-year and public 2-year campus. We restrict our distance measures to these campuses because public 2-year campuses cover virtually all 2-year enrolment, and the thirteen UW 4-year campuses cover 62% of baccalaureate college enrolment among low-income students. Figure 5 shows students' propensities to attend a baccalaureate college by the distance between their high school and the nearest UW 4-year campus. The relationship between distance and baccalaureate college attendance is strong. On average, a low-income student who attends high school within five miles of a UW 4-year campus is about 5 percentage points more likely to attend a baccalaureate college compared to a student whose high school is 40 miles away, all else equal.

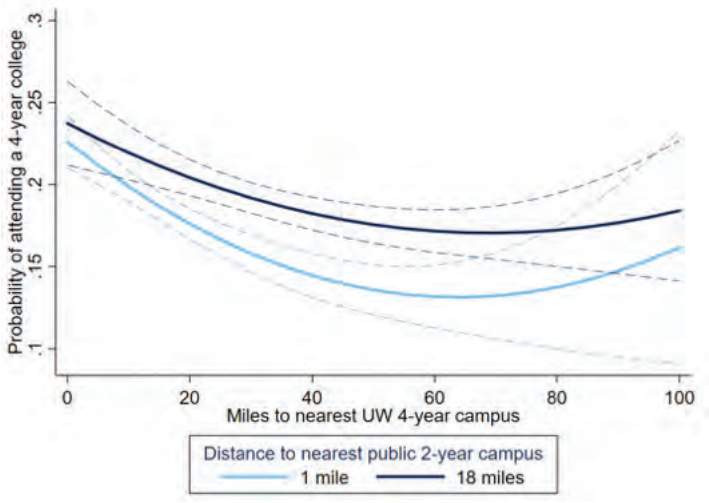
The estimated influence of nearby UW 4-year campuses varies by students' high schools' proximities to 2-year colleges. The light blue curve in Figure 5 plots predicted probabilities for students whose high school is one mile from a public 2-year college, while the dark blue curve plots probabilities for students who are 18 miles from the nearest public 2-year college.[8] Students whose high schools are far from UW 4-year campuses, and yet have a public 2-year college nearby, are less likely to attend a baccalaureate college. This finding provides suggestive evidence that otherwise similar low-income students may be diverted from a baccalaureate to a 2-year college if there is a 2-year college nearby.[9]

8 In our sample, 1 and 18 miles are the 10th and 90th percentile of the distribution of distance to the nearest 2-year college, respectively.

9 In analyses not shown, we find that low-income students are more likely to attend a two-year college if their high school is farther from a UW 4-year campus.

Figure 5

Distance to nearest institutions and baccalaureate college attendance



Note. Predicted probabilities are from a model that controls for student demographics, eighth-grade test scores and other pre-high school controls, district-level education, median income and employment rate. Distance operationalised as a quadratic transformation of nearest UW 4-year campus, a linear term for nearest public 2-year college, and an interaction between the two distance measures. All other covariates are held at their sample means. Dashed lines are 95% confidence intervals. Sample includes all low-income ninth graders entering high school for the first time from 2006 to 2011 (N = 153,760).

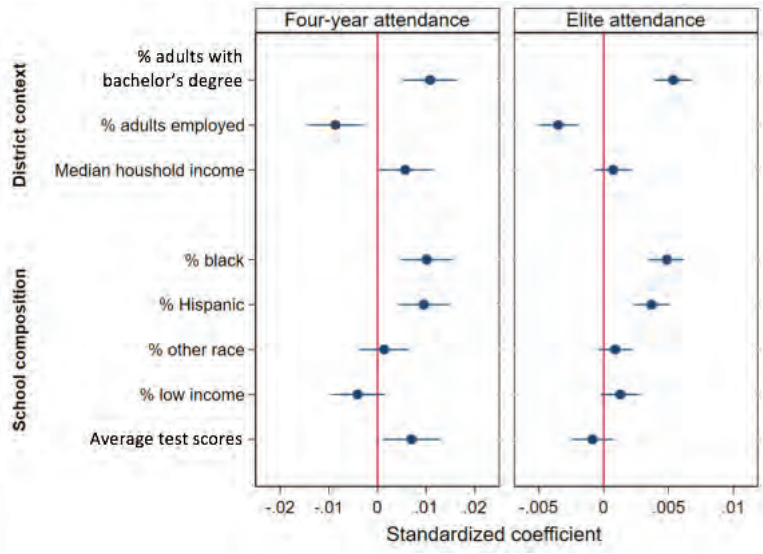
Local demographic composition

We next explore the associations between the observable features of local demographic composition and college outcomes. In general, schools in areas with a higher percentage of adults with bachelor's degrees, higher median household incomes and lower employment rates are slightly more likely to send low-income students to baccalaureate colleges and elite colleges (Figure 6). However, these associations are quite small for baccalaureate college attendance. For instance, a high school in a district that is exceptionally highly educated – concretely, 24% more local adults have bachelor's degrees compared to adults in the average district – increases the probability that a low-income student will attend a baccalaureate college by an estimated 2 percentage points. However, the same type of district increases the probability that a low-income student attends an elite college by an estimated 1 percentage point. This association is more substantial given that the overall attendance rate among low-income students is only 2%. In addition to local demographic composition, school composition also has small associations with college attendance. As Figure 6 shows, college attendance is associated with attending schools with

a higher proportion of black and Hispanic students and higher average test scores, net of controls.

Figure 6

District context and school composition conditional associations with post-secondary outcomes



Note. Coefficients are from models that control for student demographics, eighth-grade test scores and other pre-high school characteristics. Each context and compositional measure is entered in a separate model and scaled to its standard deviation across schools. Bounds show 95% confidence intervals. Sample includes all low-income ninth graders entering high school for the first time from 2006 to 2011 (*N* = 153,760).

School organisational features

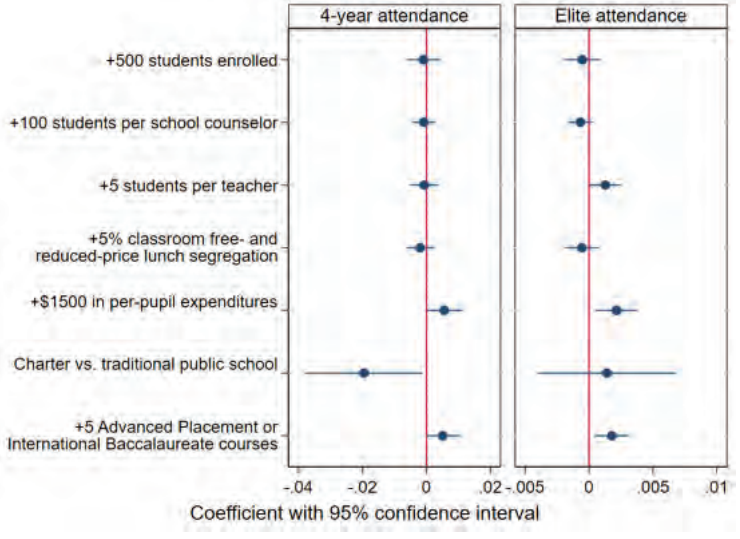
When we turn to school features that we consider more manipulable, such as personnel ratios or course offerings, we find little evidence that these factors contribute to variation in the chances that low-income students attending different high schools go on to attend baccalaureate colleges.

Figure 7 presents the results of our analysis of these measures for baccalaureate and elite college attendance. Each point estimate can be interpreted as the change in a low-income students' attendance probability associated with the stated change in each measure, holding constant students' own characteristics, their geographic context and the composition of their school. School size, school-counsellor-to-student ratio and teacher-to-student ratio are not associated with college attendance among low-income students. The extent to which low-income students are segregated across classrooms within schools also

shows no association with college going. Students who attend public charter schools are 2 percentage points less likely to attend baccalaureate colleges than observably similar students in non-charter public schools. However, charter schools serve only about 3% of public high school students and may often serve populations that were not successful in other public schools and who are therefore less likely to go to college, above and beyond the characteristics we measure. Finally, schools that have higher per-pupil expenditures and offer more Advanced Placement and International Baccalaureate courses do send slightly more low-income students to both baccalaureate and elite colleges. This last relationship is intuitive but is not necessarily causal. For instance, a school offering many different advanced classes may simply be responding to demand from its college-bound students. Taken together, these results indicate that many of the resources we expect to matter for low-income youth are not playing a substantial role in the variation we see across schools.

Figure 7

School organisational feature conditional associations with postsecondary outcomes on college outcomes among low-income students



Note. Coefficients are from models that control for student demographics, eighth-grade test scores and other pre-high school characteristics, as well as district socioeconomic context, school compositional measures and geographic measures. Each organisational measure is entered in a separate model and scaled to the stated metric unit. Bounds show 95% confidence intervals. Sample includes all low-income ninth graders entering high school for the first time from 2006 to 2011 (N = 153,760).

Discussion

This study presents four main findings for baccalaureate college attendance among low-income students at Wisconsin high schools. First, the economic disparity in baccalaureate college attendance is staggering in Wisconsin, with the most economically disadvantaged students 35 percentage points less likely to attend baccalaureate colleges than students who are not economically disadvantaged. Second, high schools vary substantially in their tendency to send low-income students to baccalaureate colleges, even accounting for the fact that students at some high schools have characteristics, such as high eighth-grade achievement, that make them more likely to attend even before the high school can influence them. Third, the geographic context of the high school matters considerably: low-income students' baccalaureate college attendance is negatively associated with being far from a bachelor's-granting UW campus, in a rural area and in an area where adults have low educational attainment. Fourth, school effects still vary considerably after including our full set of controls, suggesting the need for qualitative and survey data to help uncover what leads some high schools to send more low-income students to baccalaureate colleges than others.

Our results build on those of Engberg and Wolniak (2010) and Taylor and colleagues (2018). Both of their studies test for high school-level predictors of students' postsecondary outcomes, and we have tested for numerous additional predictors in the case of low-income secondary school students. Notably, we have shown the great role of geography, as geographic context characteristics constitute several of the school-level factors that are most substantially associated with baccalaureate college attendance. Schools have no control over their geographic contexts, in contrast to their organisational features. Consequently, by examining the role of geography, we have illuminated how between-school variation in postsecondary outcomes is not solely due to what schools are doing right or doing wrong for their low-income students; some of the differences exist simply because some schools are in more favourable locations than others.

Conclusion

Our study has two main limitations. First, students are not randomly assigned to schools and, therefore, an unknown proportion of between-school variation is attributable to student selection based on unobservable characteristics rather than to schools' differential efficacy. We have attempted to minimise this form of bias by including a rich set of control variables, but unobserved student characteristics may still bias school effect estimates. Second, causal

interpretations of the coefficients corresponding to school-level characteristics are not certain, given that we have not exploited random variation in these characteristics. For example, the association between baccalaureate college attendance and proximity to a baccalaureate college may reflect sorting of college-bound students' families across the state rather than reflecting causality.

Economic inequality in baccalaureate college attendance warrants sustained attention both in Wisconsin and nationally. While inequality in K-12 achievement is gravely important, our findings highlight that inequality does not end at 12th grade. We find a large baccalaureate college attendance gap between economically disadvantaged Wisconsinites and their more advantaged peers, even controlling for prior achievement. Narrowing the achievement gap can go a long way to reducing postsecondary disparities, but the disparities will persist without further attention to other reasons low-income students attend at lower rates.

Controlling for all of the student- and school-level characteristics that we measure, school effects still vary nontrivially: a low-income student attending one of the top 5% of schools most likely to send low-income students on to baccalaureate colleges is 20 percentage points more likely to attend a baccalaureate college than a low-income student attending one of the schools in the bottom 5%. This variation is due to some combination of unobserved student characteristics, geographic context, school composition and school organisational characteristics. While we have not identified any school organisational characteristics that are strongly associated with low-income students' baccalaureate college attendance rates, we cannot rule out that such characteristics explain part of the remaining variation in school effects, and that some of these characteristics are within the schools' control. Survey data on factors like school climate can help identify important school organisational features (Engberg & Wolniak, 2010). Qualitative research provides another possible means to discover school characteristics that promote baccalaureate college attendance, since schools may differ in important ways that no one has thought to measure. Regardless of the means, a search for *manipulable* characteristics of high schools that promote low-income students' baccalaureate college attendance has the potential to guide practice in schools and reduce disparities between low-income students and their more economically advantaged peers.

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