Effects of Reduced Community College Tuition on College Choices and Degree Completion

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Abstract

This paper studies how community college tuition rates affect students' college choices and outcomes across public and private colleges. Exploiting spatial variation in tuition rates, I find that reducing tuition at a student's local community college by $1,000 increases enrollment at the college by 3.5 percentage points (18%), increases overall college enrollment by 0.7 percentage points (1%), and reduces enrollment at non-local community colleges, for-profit institutions, and other private, vocationally-focused colleges, by 1.9 percentage points (15%). These enrollment changes increase students' persistence in college, as well as the probability that they transfer to and earn bachelor's degrees from four-year colleges.

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1 Introduction

Community colleges enroll nearly 40% of U.S. undergraduate students and are increasingly the focus of federal, state, and local college access initiatives (National Center for Education Statistics, 2018).[1] These institutions offer a variety of educational programs, including vocationally focused certificates, two-year associate degrees, and pathways to transfer to four-year colleges and universities. Moreover, community colleges offer these opportunities at a lower price than nearly all other postsecondary options, making them accessible to a large and diverse group of students, many of whom come from low-income backgrounds or are the first in their families to attend college (Ma and Buam, 2016). In recent years, policymakers have capitalized on community colleges' commitment to access in their local communities by implementing programs that make community college tuition-free (Smith, 2017).

As these types of programs grow in popularity, so too do questions about their potential consequences for students' educational attainment and labor market outcomes. Policymakers and researchers alike have long expressed concern that reducing the price of community college may deter students from enrolling in four-year colleges, potentially decreasing the probability that they earn bachelor's degrees and receive wage premiums in the labor market. Notably absent from this discussion, however, is the possibility that reducing the price of community college could deter students from enrolling in *private* colleges that offer certificates and assoicate degrees - hereafter referred to as vocational colleges. These colleges primarily operate as for-profit entities, which have grown rapidly in the past two decades and now produce over 40% of less-than-two-year certificates and nearly 20% of associate degrees in the U.S., despite having higher average tuition rates, and lower average completion rates and wage premiums than their public, not-for-profit counterparts (Deming et al., 2012; Cellini and Turner, 2018; Armona et al., 2018). While there is some evidence that com-

[1] Throughout this paper, I use the term "community college" to refer to any publicly funded college that primarily offers short-term certificates and associate degrees. Across the U.S., these institutions are also sometimes referred to as junior colleges, technical colleges, or city colleges.

munity colleges and for-profit colleges compete for students in the two-year college market, particularly in the presence of declines in state funding for public higher education (Cellini, 2009; Goodman and Henriques, 2015) or local labor demand shocks (Armona et al., 2018), there is currently no direct evidence on how tuition rates at public institutions alter students' enrollment decisions in private institutions in the two-year sector, or how such a substitution effect may impact students' longer-run educational outcomes.

In this paper, I empirically estimate the effects of community college tuition on students' college enrollment decisions and outcomes across different sectors of the postsecondary education market. To isolate exogenous variation in community college tuition rates, I exploit an institutional feature of Michigan's community college system, in which students residing on either side of a "community college district" boundary face substantially different tuition rates at their local community college due to a locally provided tuition subsidy. This feature allows me to use a boundary fixed effects strategy that compares the college choices and outcomes of students who live just inside of a community college district and face an average community college tuition rate of $2,300 per year to their peers who live just outside of a community college district and face an average tuition rate of $4,100. While this approach is similar to that used by Denning (2017) and McFarlin et al. (2018) to study community college taxing districts in Texas, I am able to build upon both studies through the use of detailed, student-level administrative data from the Michigan Department of Education that contains students' precise census blocks of residence and college enrollment and completion records across public and private colleges.

Obtaining students' census blocks of residence enables me to very accurately determine whether students reside within community college districts and to avoid the potential measurement error induced by inferring in-district status from the schools they attend. McFarlin et al. (2018) show that precisely measuring community college tuition is important in determining its effects on college enrollment, but are unable to observe in which students college enroll due to their use of restricted-access Census data. Meanwhile, Denning (2017) is able to observe detailed college enrollment and completion records, but must proxy for in-district status with the location of a student's high school. By combining data on students' precise residences with specific college enrollment records, I am better able to identify the direct effect of a community college's tuition rate on a student's decision to enroll in the college. In addition, the detailed college records in my dataset come from the National Student Clearinghouse (NSC), which covers 97% of all postsecondary institutions in the U.S., including over 70% of for-profit colleges. This coverage allows me to determine the underlying substitution effects that drive an increase in community college attendance, including whether reduced community college tuition crowds out enrollment in similar private colleges, which has not been considered in prior work.

For students graduating from Michigan public high schools between 2009 and 2016, I find that reducing the tuition rate that a student faces at her local community college by $1,000 increases the probability of enrollment at the college within a year of high school graduation by 3.5 percentage points, about 18% of the mean enrollment rate. A portion of this increase can be attributed to students enrolling in their local community college who would not have initially enrolled in *any* postsecondary education program in the absence of the tuition reduction, as a $1,000 decrease in local community college tuition increases overall college enrollment by 0.7 percentage points (1% of the mean). At the same time, this tuition decrease causes students to reduce enrollment in non-local community colleges by 1.6 percentage points (8% of the mean) and in for-profit and other private, vocationally-focused colleges that offer two-year degrees by 0.4 percentage points (11% of the mean). The remainder of the increase in local community college attendance can be attributed to a decline in four-year college attendance, however, this estimate is quite small compared to its mean and statistically insignificant.

Among students who graduated from high school between 2009 and 2011, I find further evidence that reduced community college tuition increases persistence in college and degree completion. A $1,000 decrease in local community college tuition induces students to complete 2.5% more semesters of college, and to transfer from community colleges to four-year colleges at a rate roughly 7% higher than their peers who do not receive discounted tuition. This $1,000 tuition decrease also increases bachelor's degree completion by 1.1pp (3.5%), particularly in business and professional fields such as teacher education and criminal justice. These findings support the hypothesis that diverting students from private vocational colleges to community colleges can improve student outcomes, particularly because reduced community college tuition does not increase overall college enrollment for this subset of cohorts. However, I am unable to determine the exact mechanism by which this shift in enrollment affects persistence and degree completion, as reduced community college tuition does not substantially affect the observed quality of colleges students attend.

These results contribute to several strands of literature on college choice and the consequences of public subsidization of postsecondary education. First, the results add to a large body of empirical work on the effect of college costs on students' college enrollment decisions. Most previous analyses find approximately a 3-5 percentage point increase in the probability of enrollment for each $1,000 decrease in the cost of a college option (Deming and Dynarski, 2010; Page and Scott-Clayton, 2016), with potentially even larger effects at the community college level. However, recent estimates of students' sensitivity to community college costs come from large-scale policy changes, such as introduction of free tuition policies Carruthers and Fox (2016) or the expansion of community college districts (Denning, 2017), which may affect students' choices and outcomes through multiple channels (e.g. informational campaigns, new college campuses). The results presented here isolate tuition variation by comparing observationally similar students who likely have similar exposure to college information, marketing, and campuses, and are very much in line with that of the broader literature. This suggests that, despite the already low cost of most community colleges in the U.S., students are responsive to the sticker price advertised by community colleges and that policies that reduce advertised tuition rates by even small amounts may have meaningful impacts on students' educational and labor market outcomes.

Second, this research provides the first direct evidence that students substitute towards community colleges and away from similar private colleges, including those in the for-profit sector, when community college tuition is low. Cellini (2009) and Goodman and Henriques (2015) document a similar phenomenon in the context of changes in state funding for higher education, whereby increases in funding for public colleges deter students from attending for-profit institutions, potentially because decreased funding causes colleges to increase tuition rates or decrease financial aid. In this paper, I find that this private-to-public enrollment shift also occurs as a direct result of a reduction in community college tuition and that the shift improves students' educational attainment. However, as in Denning (2017), I do not find that, on average, students forgo initially attending four-year colleges when they have access to a low cost community college or that students forgo opportunities to earn bachelor's degrees by attending community colleges. This finding comes in contrast to Carruthers and Fox (2016) who find that a broad, tuition-free community college program in Tennessee reduces four-year college enrollment, suggesting that the structure of community college tuition policies may play an important role in determining their effects on students' college choices and outcomes.

Lastly, this work contributes to an expanding literature on effects of community college attendance on educational and labor market outcomes. Because community colleges are uniquely situated between the labor market and four-year colleges, their impact on students' longer-term outcomes is often ambiguous and depends on students' counterfactual enrollment decisions (Rouse, 1995). Some students who attend community college may be made better off because in the absence of a community colleges they would not have attended any college, while others may be made worse off because they are diverted from attending four-year colleges. Empirically, students who are deterred from attending four-year colleges tend to experience an educational attainment and labor market penalty (Reynolds, 2012; Goodman et al., 2017), while students who are induced to attend their local community college rather than not attending any college experience positive educational and labor market gains (Mountjoy, 2018). I find that students who are induced to attend their local community college rather than attending a non-local community college or a private vocational college are more likely to transfer to four-year colleges and earn bachelor's degrees. This finding implies that gains from community college attendance can extend to a broader group of students than identified in prior work and suggests that expanding access to community colleges in a student's local community could increase educational attainment and improve labor market outcomes.

2 Michigan's Postsecondary Education Market

The institutional setting for this analysis is the postsecondary education market in the state of Michigan. There are over 90 accredited colleges and universities in Michigan offering a wide range of academic programs,[2] and over 90% of the state's high school graduates who enroll in college choose to attend one of them.[3] Moreover, there are two key features of the market that make it an ideal setting in which to study the effects of community college costs on students' postsecondary enrollment decisions. First, Michigan has a largely decentralized community college system in which tuition rates are determined independently by each college and are based on a student's place of residence relative to specific geographic boundaries. This creates large differences in the tuition rates faced by otherwise observationally similar students who reside on either side of a given boundary. Second, Michigan is home to a large private vocational college, Baker College, which has thirteen locations throughout the state and enrolls over 25,000 students annually. Baker offers sub-baccalaureate academic programs similar to Michigan's community colleges, but charges higher average tuition rates and spends less per student on instruction than its public counterparts. The presence of this

[2]There are also many private proprietary schools in Michigan that only award certificates and are not eligible for federal financial aid programs (Cellini and Goldin, 2014). However, these institutions are not covered by the NSC data so I cannot estimate how community college tuition affects students' decisions to enroll in them.

[3]The most popular enrollment destinations for students who attend out-of-state colleges are public institutions in neighboring states or selective private colleges and universities, predominantly in the Midwest.

competitor in the two-year college market allows me to examine whether reducing the price of a public two-year college crowds out enrollment in similar private colleges.

2.1 Michigan's Community Colleges

Michigan is home to 28 public community colleges which together enroll over 400,000 students annually (Michigan Community College Association, 2017). Each college is designed to serve a distinct geographic area, known as a *community college district*, and is given near complete autonomy over its administration. There is no overarching state law nor agency governing the specific operations of community colleges and state intervention in their practices is rare (Hilliard, 2016). The state government does, however, provide annual appropriations funding to community colleges, which accounts for approximately 20% of the community colleges' operating revenues.[4] To supplement this funding, the colleges rely heavily on both tuition and fees (43% of operating revenues) and local property taxes (35% of operating revenues). For each college, local property taxes may only be assessed on properties within its community college district (Michigan House Fiscal Agency, 2017).[5]

Community college district boundaries are set by the trustees of each college under state guidelines and may be primarily comprised of counties, public school districts, or public intermediate school districts (ISDs). Community colleges may also elect to include or exclude specific cities, townships, or other geographic features in their district. Currently, 15 of the state's 28 community college districts are comprised primarily of counties and 13 are comprised primarily of school districts or ISDs. Based on conversations with state officials

[4]This funding is allocated based on a weighted performance funding model that takes into account prior year funding, enrollment, and performance indicators, and rewards colleges for low administrative costs and adherence to state-determined best practices for community engagement (Michigan House Fiscal Agency, 2017).

[5]In 2015-2016, the average millage rate for community colleges was 2.51, i.e. \$2.51 per \$1,000 of taxable property value (Michigan Center for Educational Performance & Information, 2017). This millage rate is assessed on all properties in a community college's district, in addition to any other local property taxes (e.g. county, school district, township, or municipality taxes). Using data on aggregate real estate taxes and home values at the census tract level from the American Community Survey, I estimate that in-district areas in Michigan have an average total millage rate of 17.4, while out-of-district areas have an average total millage rate of 12.3.

and community college staff members, it is my understanding that no community college boundaries changed during the time frame of the data, and that most have remained unchanged for several decades. Figure 1, provided by Michigan's House Fiscal Agency, maps the locations and sizes of the state's 28 community college districts.

Community colleges offer tuition rates based on a student's place of residence relative to their community college district boundaries. In exchange for property tax funding, students residing within the boundaries of a district are offered the lowest tuition rate at their district's community college, averaging approximately $90 per credit.[6] Students residing within Michigan, but outside of the district, are offered the next lowest rate,[7] and students residing outside of the state are offered the highest rate.[8] Critically for the analysis at hand, a sizable portion of students reside outside of *any* community college district and face the out-of-district tuition rate at any community college they wish to attend. Using data on students' census blocks of residence, I estimate that approximately 23% of Michigan's high school graduates reside in an area that is not part of any community college district. On average, these students face tuition rates at their local community college - the college whose district area they reside closest to - that are 65% higher than those faced by their peers who live within the community college's district boundaries. This equates to an average annual cost difference of nearly $1,500 for a student taking a course load of 12 credits per semester. Given that the annual median family income of Michigan's community college students is approximately $60,000 (Chetty et al., 2017), this represents a difference of approximately 2.5% of annual median family income. Table 1 provides summary statistics on the average

[6]The tuition prices used in this paper are the colleges' advertised tuition prices, also known as sticker prices. Both in-district and out-of-district students may qualify for federal, state, local, or institutional financial aid that will reduce their net price of attendance.

[7]Macomb Community College also offers an "affiliate" tuition rate to students who reside outside of their district but in areas near their boundaries. I incorporate these tuition rates in the empirical analysis.

[8]Michigan's community colleges differ in how long a student must be a resident of the district in order to qualify for in-district tuition. However, most require several months of residency, which makes it unlikely that students who do not reside in a district while attending high school would be able to claim in-district residency upon initial enrollment.

tuition rates between 2008 and 2016, measured in 2016 dollars.[9]

In addition to the tuition variation induced by community college district boundaries, students residing in different areas of the state and graduating in different years may also face substantially different local community college tuition rates. Without government oversight of tuition-setting policies, individual community colleges are free to differ in their relative in-district and out-of-district rates, and may update these rates annually. Over the time frame of the data, real mean in-district tuition (measured in 2016 dollars) ranged from $76.90 per credit at Oakland Community College to $114.89 per credit at Mott Community College. Real mean out-of-district tuition ranged from $114.05 per credit at Wayne Community College to $221.22 per credit at Grand Rapids Community College. That is, on average between 2008 and 2016, it was less costly to be an out-of-district student at Wayne Community College than to be an in-district student at Mott Community College. Community college tuition rates, particularly for out-of-district students, have also steadily increased over the past decade. For the graduating high school class of 2008, the real average in-district tuition rate per credit was $82.47 and the average out-of-district rate was $134.46. By 2016, these average rates had increased to $106.10 and $176.58, respectively.

2.2 Other Postsecondary Choices

The remainder of Michigan's postsecondary institutions may be grouped into two mutually exclusive categories: vocational colleges and traditional four-year colleges. In this paper, I define a vocational college as a private institution that is either (1) a for-profit institution or (2) a not-for-profit institution that offers more than 25% of its degrees at the two-year level and accepts 90% or more of applicants. In Michigan, the colleges identified under this criteria and available in the NSC data are: Baker College (not-for-profit), Davenport University (not-for-profit), Everest Institute (for-profit), ITT Technical Institute (for-profit),

[9]Following the previous literature (e.g. Denning, 2017), semester tuition is calculated as the tuition rate for 12 credits and annual tuition is calculated as the tuition rate for 24 credits.

and The International Academy of Design & Technology (for-profit).[10] The largest of these institutions is Baker College, which has thirteen campuses throughout the state, in addition to a large online presence.[11] Baker enrolls over 25,000 students annually and makes up over 90% of enrollment within the state's vocational colleges.[12]

Baker is a private, not-for profit institution, but in many ways operates similarly to the more popular model of a private, for-profit college that primarily offers two-year degree programs. For example, it awards a similar share of its degrees at the associates level to the average for-profit college and similarly relies heavily on tuition payments, rather than endowments or donations, for operating expenditures. Baker also spends a similar amount on instruction per student as for-profit colleges and has a comparable percentage of full-time faculty. Appendix Table A.1 summarizes these similarities. While not all states have a large, multi-campus, not-for-profit vocational institution like Baker, most states do have a large number of students who choose to enroll in private vocational colleges, often within the for-profit sector. Given that Baker appears to operate similarly to these schools, the results from this paper should provide suggestive evidence on how reductions in local community college tuition may affect enrollment at for-profit vocational colleges, in addition to not-for-profit ones.

The remainder of undergraduate, degree-granting postsecondary institutions in Michigan are either public or private traditional four-year colleges. On the public side, Michigan has two flagship research universities, the University of Michigan-Ann Arbor and Michigan State University, and thirteen additional state universities. In recent years, the public universities have primarily relied on students' tuition payments for operating expenses as state appropriations have declined and now make up only 21% of operating budgets (Michigan House

[10]The three for-profit colleges in this list (Everest, ITT, and The International Academy of Design & Technology) shut down operations within Michigan during the time frame of the data. However, I still include them in the analysis since they were plausibly in the choice set of graduating high school students during the years they were open.

[11]Students who enroll in colleges online are included in the NSC data, but I am unable to distinguish between on-campus and online enrollment within an institution.

[12]Because of the large market share of Baker College, my results are robust to any definition of vocational colleges that includes Baker College.

Fiscal Agency, 2017). Similar to the state's community colleges, there is little government oversight of the universities' practices and, as a result, there is a substantial amount of heterogeneity in tuition rates, expenditures, and program offerings among them. However, in contrast to community colleges, all public universities offer the same tuition rate to all in-state students regardless of their location of residence. On average, the flagship universities provide a higher level of educational quality in terms of instructional expenditures and student-faculty ratios, but are also more expensive and more selective than the other public universities.

Michigan also has several private four-year institutions, including a number of liberal arts colleges and a handful of business and art schools that offer undergraduate degrees. These institutions finance their operating expenditures with students' tuition payments, private donations, and endowments as they receive minimal support from the state. They tend to be much smaller and more expensive than the state's public universities and, overall, make up a small share of the postsecondary education market. Appendix Table A.2 provides summary statistics on these institutional attributes.

Students who choose not to enroll in community, vocational, or traditional four-year colleges generally enter the state's low-skill labor market.[13] In the years following the Great Recession, young adults who have chosen this option in Michigan have faced high rates of unemployment and underemployment. Those who are employed are most likely to work in service and retail occupations, which have low median wages and minimal opportunities for advancement (Bureau of Labor Market Information and Strategic Initiatives, 2014).[14]

[13] A small number of high school graduates are also able to secure on-the-job training opportunities, such as apprenticeships. However, only about 5,000 individuals begin such programs each year, making it a relatively small component of the postsecondary education market (Bureau of Labor Market Information and Strategic Initiatives, 2016).

[14] For example, in 2013, the state's median wage for food preparation and serving occupations was \$9.02/hour and the median wage for sales occupations was \$11.98/hour (Bureau of Labor Market Information and Strategic Initiatives, 2014).

3 Data and Sample

3.1 Data Sources

The data used in this paper primarily come from a student-level, administrative dataset provided by the Michigan Department of Education (MDE) and the state's Center for Education Performance and Information (CEPI). This dataset contains academic records for all students enrolled in grades 9-12 in Michigan's public schools between 2007 and 2017 and further links these students to college enrollment and completion records from the National Student Clearinghouse (NSC) and a state-run data repository (STARR). The high school academic records provide rich information on students' demographic characteristics, including race/ethnicity, gender, free and/or reduced price lunch (FRPL) eligibility, English language learner (ELL) status, and special education enrollment; academic performance, including math and reading tests scores on a state standardized test administered in eleventh grade; and place of residence measured at the census block level.[15] The final component is a key advantage of the MDE/CEPI dataset as it allows me to very accurately determine whether a student resides within a community college district.[16] The college link provided through the NSC and STARR contains all dates and records of students' enrollments in colleges covered by either database, as well as information on the academic programs in which they enroll, the credits they complete, and the awards they receive. I match these data to postsecondary institutional information, including campus latitudes and longitudes, from the NCES' Integrated Postsecondary Education Data System (IPEDS) and the Delta Cost Project. In addition, I gather annual in-district and out-of-district tuition rates at each of

[15] Census blocks are the smallest level of geography for which the U.S. Census Bureau reports demographic data. In urban areas, a census block generally corresponds to a city block, while in suburban and rural areas, a census block is typically bounded by geographic features such as roads, streams, and transmission lines (Rossiter, 2011).

[16] This feature of the data is a particular advantage in Michigan because the state has generous school of choice policies which enable nearly 6% of K-12 students to attend a school other than that to which they are assigned (either within or outside their school district of residence). An additional 7% of students attend a charter school (Cowen et al., 2015). Thus, using the location of a student's high school to proxy for her place of residence - as is common in other settings with spatial variation (e.g. Denning, 2017) - would likely introduce measurement error to the estimation procedure.

Michigan's community colleges from Michigan's Workforce Development Agency.

3.2 Sample Construction

The goal of this paper is to estimate the causal effect of the tuition rate a student faces at her local community college on her postsecondary enrollment decisions and outcomes. To do so, I exploit the fact that students who live inside one of Michigan's community college districts face a substantially discounted tuition rate at their local community college. The challenge of this approach is that community college district areas may be spatially correlated with unobservable determinants of college choice. For example, community colleges may form their districts in geographic areas that have strong preferences for community college education, which would then bias any estimates of the effect of in-district status on college enrollment or outcomes. To mitigate this type of bias, I limit the sample to students who reside within two miles of a community college district boundary segment and add boundary segment by year fixed effects to the estimating equations.[17] This approach compares the outcomes of students who reside in close geographic proximity and graduate from high school in the same year but differ in their in-district status at the local community college.[18] Then, using this boundary sample and including the fixed effects, I instrument for the tuition rate a student faces at the local community college to directly estimate how local community college tuition affects students' college choices and outcomes.

In order to implement this empirical strategy, I first identify census blocks that are located within community college districts. To do so, I gather information on community college district boundaries and then use this information to assign census blocks to com-

[17]The two mile bandwidth is chosen to both maximize sample size and minimize observed differences between adjacent in-district and out-of-district students. Results using alternative bandwidths are included in the appendix and discussed in Section 5.5.

[18]This empirical strategy is similar in spirit to regression discontinuity (RD) designs that exploit geographically-discontinuous treatments. However, because I do not observe students' exact addresses and must aggregate to the census block level, there is a mass point in the running variable at the geographic discontinuity and I cannot use standard RD inference techniques that rely on a smooth distribution of individuals at the discontinuity (Keele et al., 2017).

munity college districts.[19] For community college districts consisting solely of counties, this is straightforward: I assign a census block to the community college district if the census block is contained within the county of interest. For community college districts that include public school districts or intermediate school districts, I first calculate the amount of geographic overlap between each census block and all overlapping school districts. I then match a census block to the school district with which it shares the most overlap and assign it to the community college district of that school district.[20] Figure 2 displays the boundaries created by this assignment algorithm along with the location of each community college's main campus.[21]

Next, I identify community college district boundaries that divide a collection of census blocks that are contained within a given community college district from a collection of census blocks that are not contained within any community college districts. These boundaries are identified in red in Figure 3. Then, in order to limit the analysis to students who differ in their in-district status, but reside within a small distance of one another, I divide each identified boundary into equal segments, each of which is no more than 5 miles long. Finally, I calculate the distance from the centroid of each student's census block to the nearest boundary segment and restrict the sample to students residing within two miles of their nearest boundary segment.[22] An example of this sample restriction for the Washtenaw Community College district area is provided in Figure 4. Each dot represents a single census

[19] I gather information on community college district boundaries from from individual community college websites, course catalogs, and conversations with colleges' institutional research staff. Appendix B lists the geographic areas that comprise each community college district.

[20] While this approach could introduce some measurement error into the estimation procedure, in practice this is not a major concern. Less than 1% of census blocks cannot be perfectly assigned to a community college district based on either their county or a single overlapping school district.

[21] Both Bay de Noc Community College and Glen Oaks Community College have "service districts" in which students face tuition rates that are greater than the in-district but lower than the out-of-district rate. I do not include boundaries that divide these areas from areas not in any community college district as they are less salient than the true community college district boundaries.

[22] In order to only include students who are likely to be affected by the local community college's listed tuition rate, I further exclude 6,687 students who are eligible for place-based promise scholarships, or whose area of residence becomes eligible for a promise scholarship during the time frame of the data. I identify areas that are eligible for promise scholarships from the Upjohn Institute's Promise Database: `https://www.upjohn.org/promise/database/`.

block centroid that is no more than two miles from the nearest boundary segment, and dots displayed in the same color are located closest to the same boundary segment. Intuitively, the empirical strategy compares the outcomes of students who live in census blocks shown in the same color, but reside inside or outside of the community college district.[23]

Table 2 provides descriptive statistics on the entire sample of students who graduate from Michigan public high schools between 2009 and 2016, and on the restricted analysis sample who live within two miles of their nearest boundary segment.[24] I also present separate means for in-district and out-of-district students in each sample. All variables are measured when a student takes the Michigan Merit Exam (MME), a required standardized test that is typically administered during a student's junior year of high school.[25] Panel A shows that 76% of Michigan's public school graduates are white, while 85% of students in the analysis sample are. This racial difference is likely driven by the placement of community college districts around urban areas, such that those residing along the boundaries tend to live in exurban and rural areas which are mostly white. There are also large differences in the share of students who are white between in-district and out-of-district students, particularly in the all students sample (72% in-district vs. 91% out-of-district). This difference is approximately half the size in the analysis sample (81% in-district vs. 91% out-of-district). In-district students are also more likely to be English language learners than out-of-district students in both samples. However, the remainder of the demographic variables are reasonably balanced across the two samples and between in-district and out-of-district students within each sample.

Panel B reports average standardized test scores, which are standardized with a mean of zero and standard deviation of one for all students who take the exam in a given year. The average scores indicate that students who graduate from high school score slightly higher on the exams than students who do not, but that the analysis sample scores similarly to

[23] I do not consider boundaries that divide two distinct community college districts, so students residing outside of a community college district of interest do not reside within any community college district.

[24] Students who graduate prior to 2009 or after 2016 are dropped from the sample due to incomplete college enrollment and completion data collection. Students enrolled in juvenile detention centers, adult education, or alternative education programs are also dropped from the sample.

[25] Students who do not have records of the MME are not included in the sample.

students across the state. However, out-of-district students score higher than in-district students in both samples. About 10-12% of graduates, both overall and in the analysis sample, use Michigan's school of choice policies, and the vast majority of students in both samples graduate from high school on time. These variables are similar across in-district and out-of-district students each sample. About 10% of graduates in each sample dual enroll in a college course while in high school, although this share is higher for out-of-district students, particularly in the all students sample.[26]

Lastly, Panel C reports college enrollment outcomes for the first year following a student's graduation from high school. In both samples, about 30% of high school graduates enroll in a community college, with more in-district students doing so than out-of-district students, especially in the all students sample. About 3% enroll in a vocational colleges, with less in-district students doing so than out-of-district students. In the sample of all students, about 41% of graduates enroll in a four-year college, while about 38% do so in the analysis sample. There are little differences in this rate between in-district and out-of-district students. In total, about 70% of all Michigan public high school graduates enroll in college within one year, while about 67% of the analysis sample does, with more in-district students enrolling in college in both samples.

4 Empirical Strategy

This boundary fixed effects approach, as outlined in Figure 4, naturally lends itself to the following reduced form estimating equation:

$$Y_{ibt} = \gamma + \delta District_i + \mathbf{X}_i \mathbf{\Psi} + \mu_{bt} + \nu_{ibt}, \tag{1}$$

[26]All high school students in Michigan, regardless of whether they live in a community college district, have the opportunity to dual enroll in college courses at no direct cost to their families. The state's Postsecondary Enrollment Options Act requires that school districts pay tuition and fees for most college-level academic courses in which a student wishes to enroll, conditional on that course not being offered by the student's high school (Michigan Department of Education, 2017).

where Y_{ibt} is a binary outcome of interest for student i who resides along boundary segment b and graduates from high school in year t. For example, Y_{ibt} may be a binary variable representing enrollment in the local community college or completion of a bachelor's degree. $District_i$ is a dummy variable equal to 1 if student i resides in a community college district and equal to 0 otherwise. $\mathbf{X}_i$ is a vector of individual level control variables that may affect college enrollment choices, such as a student's socioeconomic background and academic aptitude. μ_{bt} is a full set of boundary segment by year fixed effects, and ε_{ibt} is an idiosyncratic error term. The coefficient of interest is δ, which represents the effect of residing in a community college district on Y_{ibt}.

This reduced form equation may also be extended to a set of two-stage least squares (2SLS) equations in order to directly estimate the causal effect of the tuition rate at the local community college on students' college choices and outcomes. The first stage equation is:

$$Tuition_{ibt} = \zeta + \lambda District_{ib} + \mathbf{X}_i\mathbf{\Phi} + \mu_{bt} + \upsilon_{ibt} \tag{2}$$

and the second stage equation is:

$$Y_{ibt} = \alpha + \beta \widehat{Tuition}_{ibt} + \mathbf{X}_i\mathbf{\Gamma} + \mu_{bt} + \varepsilon_{ibt}. \tag{3}$$

where $\widehat{Tuition}_{ibt}$ is predicted from the first stage, and the remainder of the variables are defined as in previous equations.

In order for β to represent the causal effect of local community college tuition on students' choices and outcomes, it must be the case that (1) $Cov(District_{ib}, Tuition_{ibt}|\mathbf{X}_i, \mu_{bt}) \neq 0$ and that (2) $Cov(District_{ib}, \varepsilon_{ibt}|\mathbf{X}_i, \mu_{bt}) = 0$. The first assumption states that, within a narrowly defined geographic area and graduation year, and after controlling for observable characteristics, a student's in-district status is related to the tuition rate he or she faces at the local community college. That is, there must be a price differential between in-district and out-of-district students residing along a community college district border, and this price differential must not be entirely explained by differences in observable characteristics. Given that all community colleges in Michigan set different tuition rates for in-district and out-of-district students, and that these tuition rates are set for the entire in-district and out-of-district areas (not just the students on the boundaries), this assumption should hold. However, it is also directly testable in the data. Table 3 presents the estimated first stage value of λ in three specifications of equation (4): including no control variables, including only distance-related control variables, and including a full set of distance and student control variables.[27] The estimated values indicate that in-district students face a local community college tuition rate that is approximately $1,800 lower than that of their out-of-district peers, which is nearly identical to the raw difference in tuition rates between in-district and out-of-district students residing along community college district boundaries. This finding suggests that observable characteristics of students along community college district boundaries do not strongly predict the tuition differentials. In addition, all three estimates have large F-statistics, decreasing the probability that the 2SLS estimates suffer from weak instrument bias.

The second assumption states that, within a narrowly defined geographic area and graduation year, and after controlling for observable characteristics, a student's in-district status is uncorrelated with unobservable determinants of college choices or outcomes. This is also the assumption needed for identification of δ in the reduced form equation. This assumption rules out the possibility that, for example, families choose to live in community college districts due to unobserved preferences for community college attendance.[28] This is inherently

[27]The distance-related variables are the distance between a student's census block of residence and the local community college, the nearest vocational college, the nearest public university, and the nearest private four-year college. The student control variables are: a student's race (white, black, or Hispanic), gender, FRPL status, special education participation, ELL status, math and reading test scores, school of choice participation, on-time graduation status, and dual enrollment experience.

[28]A related concern is that families choose where to live on based on preferences for other types of taxes or public goods, which may be correlated with their preferences for education more generally. However, I find that, along the boundaries, in-district residents face an average millage rate of 15.4, while out-of-district residents face an average rate of 12.3. Given that the average community college millage rate is about 2.5, this suggests that there is only about a 0.6 millage difference (i.e. $0.60 per $1,000 of taxable value) attributable to other types of taxes, which is rather small and unlikely to explain residential choices.

untestable. However, there are several reasons to believe that this assumption is likely to hold. First, community college district boundaries are not well-publicized by the state of Michigan. The state does not maintain any publicly-available record of community college district boundaries and each community college has discretion over whether and how they make this information available to potential students and families. Thus, it is possible that a family could select a place of residence without knowing whether or not it is contained within a community college district.[29]

Second, very few students move into community college districts between 9th and 12th grade. This suggests that families do not anticipate community college attendance and move to take advantage of the subsidized tuition rates offered to in-district students. While nearly 14% of all students move census blocks during high school, less than 1% move from an out-of-district census block to an in-district census block.[30] Moreover, conditional on beginning high school in a community college district, a student has a probability of finishing high school in a community college district of 99%. In contrast, conditional on beginning high school outside of a community college district, a student has a probability of finishing high school in a community college district of 4%.

Third, students residing on either side of a community college district boundary appear quite similar across observable characteristics. To assess balance between peers residing on either side of boundaries, I estimate regressions of the form:

$$X_{ibt} = \gamma + \delta District_i + \mu_{bt} + \upsilon_{ibt}. \tag{4}$$

Here, the coefficient δ represents the average difference in an observable characteristic between in-district and out-of-district students who reside along a given boundary segment

[29]Property taxes for the local community college are generally displayed on the tax bills of property owners who reside within community college districts. However, there is no indication of in-district status, nor tuition rates, on these bills.

[30]Author's own calculation based on a sample of students who have records for all grades 9-12 and non-missing census block information in at least two of those grades.

and graduate from high school in the same year.[31] I cluster standard errors at the boundary segment level to account for systematic correlation in the error term among students who reside near one another.

Table 4 reports estimates of δ across a large set of observable student characteristics. The results indicate that students residing near one another, but on opposite sides of a community college district boundary, are very similar to one another. These students are similarly likely to be white, to be eligible for free or reduced price lunch, and to be English language learners. They also score similarly on standardized tests, and graduate on-time from high school at similar rates. The only attributes across which the two groups differ are special education status and dual enrollment participation. In-district students are both less likely to be classified as special education students and slightly less likely to dual enroll in a college course while in high school, although the latter result is only marginally statistically significant.[32]

Despite these mitigating factors, the largest threat to identification is the fact that community college district boundaries are often congruent with either county or school district boundaries, inducing compound treatments at the cutoff points (Keele et al., 2017). In the absence of additional information, this fact makes it is impossible to distinguish the effect of residing in a community college district from the effect of any other treatments that change discontinuously along county or school district boundaries. To my knowledge, there are no other specific community college policies that are discontinuously applied along community college district boundaries; however, the overlap of school districts and community college districts is concerning for two reasons.[33] First, school districts may provide different college

[31] Additional regressions of an indicator for high school graduation on in-district status reveal that in-district and out-of-district students on either side of community college district boundaries graduate from high school at statistically the same rates.

[32] Additional analyses suggest that in-district students are also less likely to be school of choice students, but this is unsurprising given that in-district school districts tend to be more suburban and students residing in rural areas are more likely to choice in to suburban school districts than suburban students are to choice in to rural districts.

[33] The overlap of counties and community college districts is less concerning as the vast majority of college advising and implementation of college access policies occurs at the school, school district, or intermediate school district level, rather than the county level.

information and guidance to students, and second, families often select where to live based on school district attributes (Caetano and Macartney, 2014) - one of which could be the quality of the school district's college advising. To address both of these concerns, in Section 5.5, I repeat the analysis using a subset of students who live in school districts which are bisected by a community college district boundary. Students in this sample come from families who chose to live within the school district's boundaries, and therefore likely have similar preferences for education, and overwhelmingly attend the same high school, and therefore likely receive similar college counseling. However, only a fraction of the students live within the local community college's district. I find that those students who live within the college's district are much more likely to attend the local community college than their high school peers who live outside of the college's district, suggesting that neither residential sorting nor school-level policies are likely driving my main results.

5 Results

I estimate the boundary fixed effect models for a variety of college enrollment and completion outcomes. For each outcome of interest, I first present reduced form results that estimate the "policy effect" of residing in a community college district: δ in equation (1). I then present estimates of the "tuition effect" of reducing a student's local community college tuition rate by \$1,000: $-\beta*1000$, where β is defined as in equation (3). For college completion outcomes, I restrict the sample to students who graduated from high school between 2009 and 2011 as these students have had sufficient time to complete college credentials. Unless otherwise indicated, all regressions include control variables for a student's race/ethnicity (white, black, or Hispanic), gender, FRPL status, special education participation, ELL status, math and reading test scores, school of choice participation, on-time graduation, and dual enrollment experience, as well as the distance between the centroid of a student's census block of residence and the nearest campus of the local community college, the nearest vocational college, the nearest in-state public university, and the nearest in-state private four-year college. These variables are designed to control for socioeconomic and academic factors that may affect students' preferences over postsecondary choices.

5.1 College Enrollment

Table 5 presents the reduced form and 2SLS estimates for student's college enrollment choices within one year of high school graduation. The first four columns present estimates for four mutually exclusive college categories - the local community college (that at which in-district students receive reduced tuition), non-local community colleges, private vocational colleges, and four-year colleges. However, students may enroll in more than one type of college within their first year following high school graduation, such that the sum of these estimates need not exactly equal the overall college enrollment effect presented in column (5). Panel A presents estimates for all cohorts of students, while Panel B presents estimates only using the 2009-2011 cohorts who will be used for analyses of college completion.

The first row of each panel presents the reduced form effects of residing in a community college district. For the "all cohorts" sample, residing in a community college district increases enrollment in the local community college within one year of high school graduation by 6.4pp (31%), while decreasing enrollment in non-local community colleges by 2.8pp (31%) and in private vocational colleges by 0.7pp (20%). That is, students shift enrollment away from other two-year colleges and towards their local community college when they reside in a community college district. In contrast, there is no statistically significant effect of in-district status on enrollment in four-year colleges, and the point estimate is quite small: -1pp, or 2.7% of the mean enrollment rate. On net, these enrollment effects increase overall college enrollment within one year of high school graduation by 1.3pp, or approximately 1.9% of the mean enrollment rate of 67.3%. The community college and vocational college enrollment effects are qualitatively similar for the 2009-2011 cohorts, however, the overall college enrollment effect for this subsample is much smaller (0.6pp) and not statistically different from zero. All changes in enrollment behavior for these cohorts come from switching between community colleges and vocational colleges.

The second row of each panel presents the 2SLS estimates of the effect of reducing the tuition rate at a student's community college by $1,000. Across all students, this reduction in tuition increases enrollment at the local community college by 3.5pp (18%), and is primarily driven by a 1.5pp (17%) decrease in enrollment in non-local community colleges and a 0.4pp decrease in enrollment in private vocational colleges (11%). As in the reduced form specifications, there is no statistically significant decrease in four-year college enrollment as a result of this tuition reduction, and the point estimate is quite small, representing only about 1% of the mean enrollment rate. Taken together, these enrollment effects increase overall college enrollment in the year following high school graduation by 0.7pp, or approximately 1% of the mean enrollment rate of 67.3%. Again, the community college and vocational college enrollment effects are qualitatively similar using the 2009-2011 subsample, but the the overall enrollment effect is small (0.4pp) and statistically insignificant.

5.2 College Major

Given that residing in a community college district affects *where* a student attends college, it is natural to think that in-district status may also affect *what* she studies once enrolled in college, since different colleges offer different majors. A shift in students' college majors may in turn affect their labor market outcomes, either directly through providing different wage premiums, or indirectly through affecting students' ultimate educational attainment.[34] For example, community colleges tend to offer both vocational training programs and general education programs that are designed to assist students in transferring to four-year colleges. Vocational colleges, however, generally only offer vocational training programs. If residing in a community college district encourages students to attend community colleges and complete the same vocational programs offered at vocational colleges, then this shift is unlikely to

[34] See Bahr et al. (2015); Stevens et al. (2018) for evidence on the returns to college majors in the community college context.

affect their probability of pursuing further education at four-year colleges. In contrast, if residing in a community college district induces students to complete transfer programs at community colleges, then this may affect students' probabilities of transferring to four-year colleges and earning bachelor's degrees.

To estimate the effect of in-district status and reduced community college tuition on students' college major choices, I rely on the rich detail of student's academic programs included in the MDE/CEPI dataset. The dataset records the six-digit federal Classification of Instructional Program (CIP) code of the programs in which they enroll, which I then aggregate into seven broad categories similar to those used in Bahr et al. (2015): general studies, liberal arts, health, business, technical, professional and other.[35] At the community college level, the "general studies" category primarily consists of programs designed to assist students in transferring to four-year colleges. These programs often culminate in Associate of Arts (AA) or Associate of Science (AS) degrees, whereas more vocationally-oriented programs will lead to Associate of Applied Arts (AAA) or Associate of Applied Science (AAS) degrees. At both the two-year and four-year levels, the liberal arts category consists of traditional arts, natural sciences, social sciences, and humanities programs. The health category contains all health-related programs, such as nursing, and the business category contains all business, management, marketing, and related programs. The technical category consists of engineering fields, along with technical sciences and trades, such as construction trades, and precision production. The professional category includes a variety of academic programs designed to lead to specific career tracks, such as criminal justice, health and physical education, communication and media studies, and teacher education. Appendix Table A.3 lists the full set of two-digit CIP codes included in each category.

Table 6 reports the reduced form and 2SLS effects of residing in a community college district on a student's first choice of college major, conditional on ever enrolling in college. Once again, Panel A reports estimates for all students, while Panel B reports estimates

[35] The "other" category also includes students who have a recorded college enrollment but do not have a recorded program in the data.

only for the 2009-2011 cohorts. The first row of each panel estimates how residing in a community college district affects college major choice. For the sample of all students, in-district status increases the probability that a college enrollee will initially choose a general studies program by 1.6pp, which is an approximately 6% increase of the mean enrollment rate of 25.5%. This increase primarily comes from a reduction in the probability of choosing a liberal arts, technical, or professional field of study, although only the latter outcome is statistically significant at conventional levels. The second row in each panel estimates the effect of a $1,000 decrease in local community college tuition on students' college majors. This tuition decrease increases enrollment in general studies programs by 0.9pp for the whole sample, and by 1.8pp for the 2009-2011 cohorts.

5.3 College Completion

Table 7 estimates how residing in a community college district affects longer-run educational outcomes for the 2009-2011 cohorts. The first row of the table presents reduced form effects. In-district status increases the total number of college semesters students complete by 0.344 (4.2%) and increases the probability that a student will transfer from a community college to a four-year college by 1.2pp (11.1%).[36] Residing in a community college district does not significantly affect students' completion of certificates nor associate degrees, but increases bachelor's degree completion by 1.8pp (5.7%). The 2SLS results in the second row indicate that reducing a student's local community college tuition rate by $1,000 increases the number of semesters of college she completes by 0.206 (2.5%), her probability of transferring from a community college to a four-year college by 0.7pp (6.5%), and her probability of completing a bachelor's degree by 1.1pp (3.5%).

Given that there is no statistically significant overall increase in college attendance for the 2009-2011 cohorts, the increases in persistence and degree completion must be driven by

[36] Michigan has had some form of community college transfer agreement since 1972. In 2014, the state created the Michigan Transfer Agreement, which allows students to seamlessly transfer 30 general education credits from community colleges to the state's public four-year universities (Michigan Community College Association, 2014).

students attending their local community college rather than non-local community colleges or vocational colleges. To better understand why such a substitution effect improves students' outcomes, I estimate how in-district status and reduced community college tuition affects the quality of colleges students initially attend. Appendix Table A.4 presents the reduced form and 2SLS estimates of this analysis across five measures of college quality. I do not find any statistically significant differences in college quality between in-district and out-of-district students, although there is suggestive evidence that students who are eligible for discounted community college tuition sort into colleges that spend more on instruction and academic support. Future research should seek to better understand the mechanisms that underly the benefits of attending a local community college, such as decreasing student debt levels due to living with family members or providing more robust support networks for students seeking to transfer to four-year colleges.

Finally, to assess whether the increase in degree completion is likely to translate into labor market gains, Table 8 reports the distribution of associate and bachelor's degree increases by field of study. For each estimate, the outcome of interest is whether a student completes a given degree in a given field, so the summation of coefficients across the table's columns must equal the overall completion estimate from Table 7. Panel A reports changes in associate degree completion by field, and indicates that a \$1,000 decrease in a student's local community college tuition rate increases her probability of earning a general studies associate degree by 0.6pp (17.1%). There are no statistically significant decreases in associate degree completion in other fields. Panel B reports changes in bachelor's degree completion by field. The increase in bachelor's degree completion reported in Table 7 is driven by increases in bachelor's degree completion in business and professional fields of study. A \$1,000 decrease in a student's local community college tuition rate increases her probability of earning a business bachelor's degree by 0.4pp (7.8%) and earning a bachelor's degree in a professional field by 0.7pp (8.0%). Given that business majors experience substantial earnings gains in the labor market (Andrews et al., 2017), this increase in degree completion is likely to have longer-term payoffs for students.

5.4 Heterogeneity

The average enrollment and completion results presented in Tables 5 and 7 are unlikely to be homogeneous across the student population, and may differ across students in ways that are theoretically ambiguous. For example, students from economically disadvantaged backgrounds may be more sensitive to the advertised cost of the local community college option than their non-disadvantaged peers, or they may be less-sensitive because they are eligible for other state and federal grant programs. Similarly, students with high academic aptitude may never consider the local community college option regardless of its price, or they may see it as a low-cost pathway to attending a selective four-year university. Thus, understanding which students are most responsive to the cost of their local community college can provide additional insight into students' decision-making process. Table 9 reports heterogeneous treatment effects by a student's FRPL status, gender, and test score for select college enrollment and completion outcomes.[37]

Panel A reports the effect of residing in-district by a student's free or reduced price lunch (FRPL) eligibility, a proxy for a student's family's economic status. FRPL eligible and ineligible students respond similarly to residing in a community college district with regards to local community college enrollment, but their substitution patterns are different. FRPL ineligible students, who come from higher-income families, respond to living in a community college district by changing *which* community college they attend: they are 3.3pp less likely to enroll in a non-local community college and 6.7pp more likely to enroll in their local community college. In contrast, FRPL eligible students respond to in-district status by reducing non-local community college enrollment by only 1.5pp. These students also decrease

[37] For the binary FRPL status and gender variables, I extend equation (1) to include an interaction term between $District_i$ and the demographic variable of interest. For the test score variable, students are assigned to score quartiles among all students who took the MME exam in the same year based on their combined scores on the math and reading exams. Equation (1) is then modified to include a dummy variable for the middle two quartiles, a dummy variable for the top quartile, and interaction terms with these dummy variables and $District_i$.

enrollment in vocational colleges by 0.8pp and and increase overall college enrollment by 1.8pp. This indicates that having access to a low-tuition local community college option is particularly important for overall college enrollment for lower income students, despite their eligibility for Pell grants and other need-based financial aid programs.[38] However, FRPL eligible and ineligible students earn associate and bachelor's degrees at comparable rates.

Panel B presents estimated effects by a student's gender. Male students are more responsive to in-district status: they are 7.2pp more likely to attend the local community college than their out-of-district peers, whereas female students are 5.6pp more likely to do so. The underlying substitution effects are also different by gender. Female students respond to in-district status by significantly reducing enrollment in non-local community colleges and vocational colleges, while male students only somewhat reduce enrollment in non-local community colleges and also reduce enrollment in four-year colleges. However, this reduction in four-year enrollment is not statistically different than that of female students. Moreover, as in the case of FRPL eligible and ineligible students, these differences do not persist when looking at completion outcomes. Residing in a community college district increases associate and bachelor's degree completion similarly for male and female students, suggesting that male students who are induced to attend their local community college rather than a four-year college are not forgoing opportunities to earn bachelor's degrees.

Lastly, Panel C reports the estimated effects by students' test scores. Students from the bottom three test score quartiles are very responsive to residing in a community college district: it increases their probability of enrolling in the local community college by 7.4-7.5pp. In contrast, students from the top quintile respond to in-district status by increasing their enrollment in the local community college by only 2.9pp. There are also differences among these groups when considering substitution effects. Students from bottom quartile forgo enrollment in non-local community colleges, vocational colleges, and four-year colleges, whereas students from the middle quartiles primarily forgo enrollment in other community

[38] This may be due to the complexity of the financial aid system, which can deter students from enrolling in college (Bettinger et al., 2012).

colleges. However, there are no decreases in bachelor's degree attainment among any group of students, which again suggests that the students who are deterred from attending four-year colleges do not forgo opportunities to earn bachelor's degrees. These students may even experience welfare improvements given the low loan repayment rates of students who enroll in colleges but do not complete degrees (Itzkowitz, 2018).

5.5 Robustness Checks

The reduced form and 2SLS results both rely on the assumption that there are no unobservable differences between students residing on either side of a community college district boundary that affect their college choices and outcomes. One threat to this assumption is that the two mile bandwidth does not create appropriate treatment and control groups because individual students may live several miles from one another, and therefore, may have different preferences over postsecondary education options or may be exposed to different social networks and information about college. To test whether the results hold across comparisons of students who reside closer to one another, I re-run the 2SLS estimation procedure using bandwidths of three miles, one mile, one-half of a mile, one-quarter of a mile, and one-tenth of a mile. Appendix Figure A.2 visually presents these estimates for local community college enrollment. While the point estimates are somewhat sensitive to the bandwidth chosen, ranging from 1.7pp to 3.9pp, all estimates are statistically different from zero. In addition, the 95% confidence intervals for all estimates contain the 3.5pp estimate from the two mile bandwidth.

Perhaps the most salient threat to the identifying assumption, however, is the fact that community college district boundaries are often congruent with school district boundaries, and a non-trivial share of families choose where to live based on school district characteristics (Caetano and Macartney, 2014). To test whether differences in school districts drive the college enrollment and completion results, I provide an alternative specification that compares the college choices and outcomes of students who reside in the same school district but live on opposite sides of a community college district boundary. Since Michigan's community college districts may be comprised of a variety of geographic features, there are areas in which a school district is not located entirely within or outside of a community college district. This occurs when a community college district is congruent with a county (or multiple counties), but school districts in the area span more than one county. There are twenty-five such school districts in the state in which at least 10% of the high school residents reside within the community college district and at least 10% reside outside. Appendix Figure A.1 identifies these school districts in gray, and Appendix Table A.5 lists their names and associated community college districts. Using these school districts as the analysis sample eliminates the concern that families sort into more desirable school districts that are located in community college districts. In addition, it holds constant college counseling information provided by the school district as the majority of students residing within one of these school districts attend the same high school. Twenty-four of these twenty-five school districts contain only one high school, and 92% of students attend a high school that is located within their district of residence. Thus, comparing the outcomes of in-district and out-of-district students within these districts should suggest whether the previous results are biased from unobservable selection into in-district school districts or compound treatments at the school district level.

To do so, I repeat the reduced form and 2SLS analyses, but replace the boundary segment by year fixed effect with a school district of residence by year fixed effect. I again drop students eligible for promise scholarships and include the same set of control variables as in Section 5. Table 10 presents results from this analysis for enrollment in the local community college for the 2009-2016 cohorts and bachelor's degree completion for the 2009-2011 cohorts. The first column of the table presents the local community college enrollment results from the main specification: as in Table 5, residing in a community college district increases enrollment at the local community college by 6.4pp, and reducing the tuition rate at the local community college by $1,000 increases enrollment by 3.5pp. The second column presents results from the alternate, within school district specification. Using this sample and specification, residing in-district increases enrollment at the local community college by 5.0pp, and reducing the tuition rate by $1,000 increases enrollment by 3.2pp. Neither of these estimates is statistically different from the analogous estimates produced by the main specification.[39] The third and fourth columns repeat this comparison for bachelor's degree completion. The reduced form and 2SLS results are both statistically insignificant, but the point estimates are very close to, and statistically indistinguishable from, those produced by the main specification. Taken together, these comparisons suggest that the main specification's college enrollment and completion results are unlikely to be driven by selection into particular school districts, nor college information provided by school districts.

Another way to check the robustness of the main results is to examine whether college enrollment choices and completion outcomes discontinuously change along geographic boundaries other than community college districts. If the differences in college outcomes between in-district and out-of-district students residing along a community college district border are truly driven by differences in tuition rates, then there should be no differences in college choices nor outcomes along borders where tuition rates do not differ and there are not other related policies in place. To test whether this is true, I conduct two different placebo tests. First, I contract all community college district perimeters by two miles and compare the college choices of students residing within two miles of the new placebo boundary. This approach compares the choices and outcomes of students who all live within the same community college district, and face the same low tuition rate, but differ in how close they live to the center of the community college district. Second, I expand all community college district perimeters by two miles and compare the college choices of students residing within two miles of the new placebo boundary. In this approach, I compare students who live outside of a community college district but differ in how close they live to the nearest

[39] Appendix Table A.6 contains estimates for all one-year enrollment outcomes using this alternative specification. Given the reduced sample size, these estimates lack precision but are qualitatively similar to those produced by the main specification.

community college district boundary.[40]

The results from these approaches for local community college enrollment and bachelor's degree completion are presented in Table 11. The first column indicates that students residing within a community college district, but on either side of the contracted placebo boundary, do not differ in their likelihood of attending the local community college. The second column shows that students residing outside of a community college district, but on the side of the expanded placebo boundary that is closer to the true community college district are slightly more likely to attend the local community college. However, this estimate (0.7pp) is quite small compared to the estimate of 6.4pp along the true community college district boundaries and is only marginally significant. The third column indicates that students who reside within a community college district, but inside the contracted placebo boundary, are slightly less likely to obtain bachelor's degrees, while the fourth column indicates that out-of-district students living on either side of the expanded placebo boundary are equally likely to obtain a bachelor's degree. Both sets of results indicate that enrollment and completion outcomes do not change in meaningful ways along non-community college district boundaries, providing additional validation that the main results are truly caused by reduced community college tuition.

6 Conclusion

Community colleges serve millions of undergraduate students each year and are increasingly the focus of college access policies. Both the prevalence of these institutions and the attention given to them by policymakers makes it critical to understand how students respond to their costs. In this paper, I provide new evidence on the effect of community college tuition rates on students' college enrollment decisions, persistence in college, and degree completion. To do so, I exploit the fact that Michigan's community colleges offer students

[40]In both approaches, I follow the approach of my main specification and divide the boundaries into equal boundary segments that are each no more than 5 miles in length.

different tuition rates depending on whether they live within our outside a college's district boundaries, as well as the fact that nearly one-quarter of Michigan's high school graduates do not live within the boundaries of any community college district. This geographic variation allows me to use a boundary fixed effects design that compares the outcomes of students who reside on either side of a community college district but who are otherwise observationally similar. I combine this approach with detailed administrative records from the Michigan Department of Education in order to track students' residences, college enrollment choices, and college completion outcomes over time.

Among students graduating from Michigan public high schools between 2009 and 2016, I find that a $1,000 decrease in the advertised tuition rate at a student's local community college upon graduating high school increases the probability of enrollment at the college by 3.5pp, or about 18%. This increase in local community college enrollment can be partially attributed to an increase in overall college enrollment, but is also due to a decrease in enrollment at non-local community colleges and at private vocationally-focused colleges who offer similar degree programs to community colleges. However, I find little evidence that students forgo attending four-year colleges or decrease their overall educational attainment in response to a low community college tuition rate. Instead, for students who graduate from high school between 2009 and 2011, I find an increase in persistence in college, transfer to four-year colleges, and bachelor's degree completion. These improved outcomes may be attributed to the substitution towards local community colleges and away from non-local community colleges and vocational colleges, as overall college enrollment is not affected by reduced community college tuition for this subset of students. This finding suggests that gains from community college attendance can extend to more students than identified in prior work (Rouse, 1995; Reynolds, 2012; Mountjoy, 2018), namely students who would attend a private vocational college in the absence of a community college. As a result, policies that encourage students to attend community colleges rather than for-profits and similar institutions likely have the potential to improve students' educational and labor market outcomes.

One limitation of these results is that I am unable to determine the precise mechanisms by which attending a local community college, rather than a non-local community college or private vocational college, improves students' outcomes as there is no difference in the observed quality of colleges students attend. However, there may be unobserved differences between these types of colleges, and thus, understanding the gains to attending a local community college education is a fruitful avenue for future work. A second limitation of this study is that the results are estimated from an empirical design that compares students living very near one another, and thus, does not address the role of distance in college choices. Given the documented relationship between college proximity and college attendance (Card, 1995; Currie and Moretti, 2003; Lapid, 2017), it is likely that rural students who live far from colleges face additional challenges in accessing higher education and may not respond to reduced tuition as strongly as their non-rural peers. Future work should also seek to identify how reduced tuition policies differentially affect rural students and should investigate alternative policy interventions to increase college-going behavior among this population.

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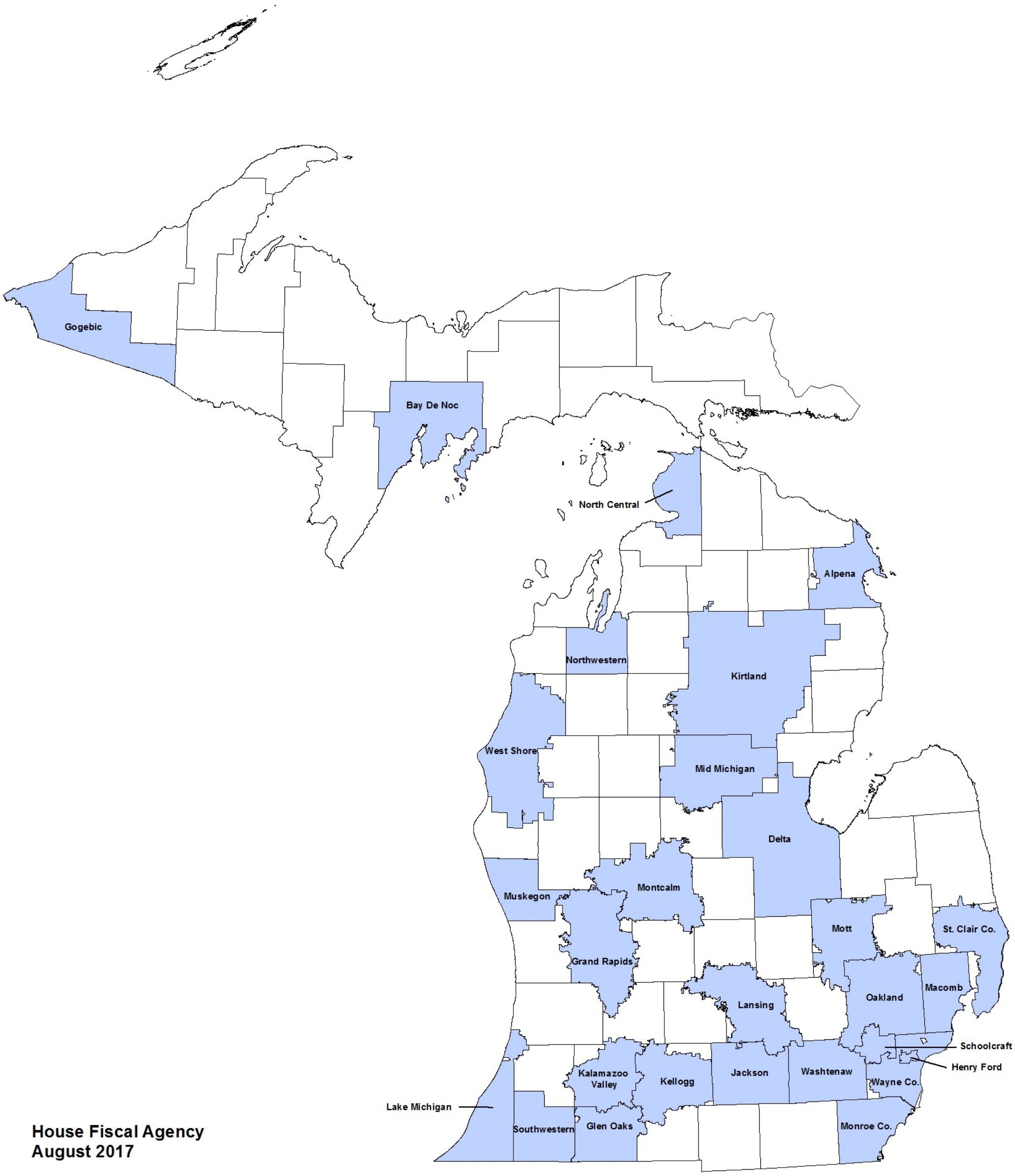

Figure 1: Michigan's Community College Districts

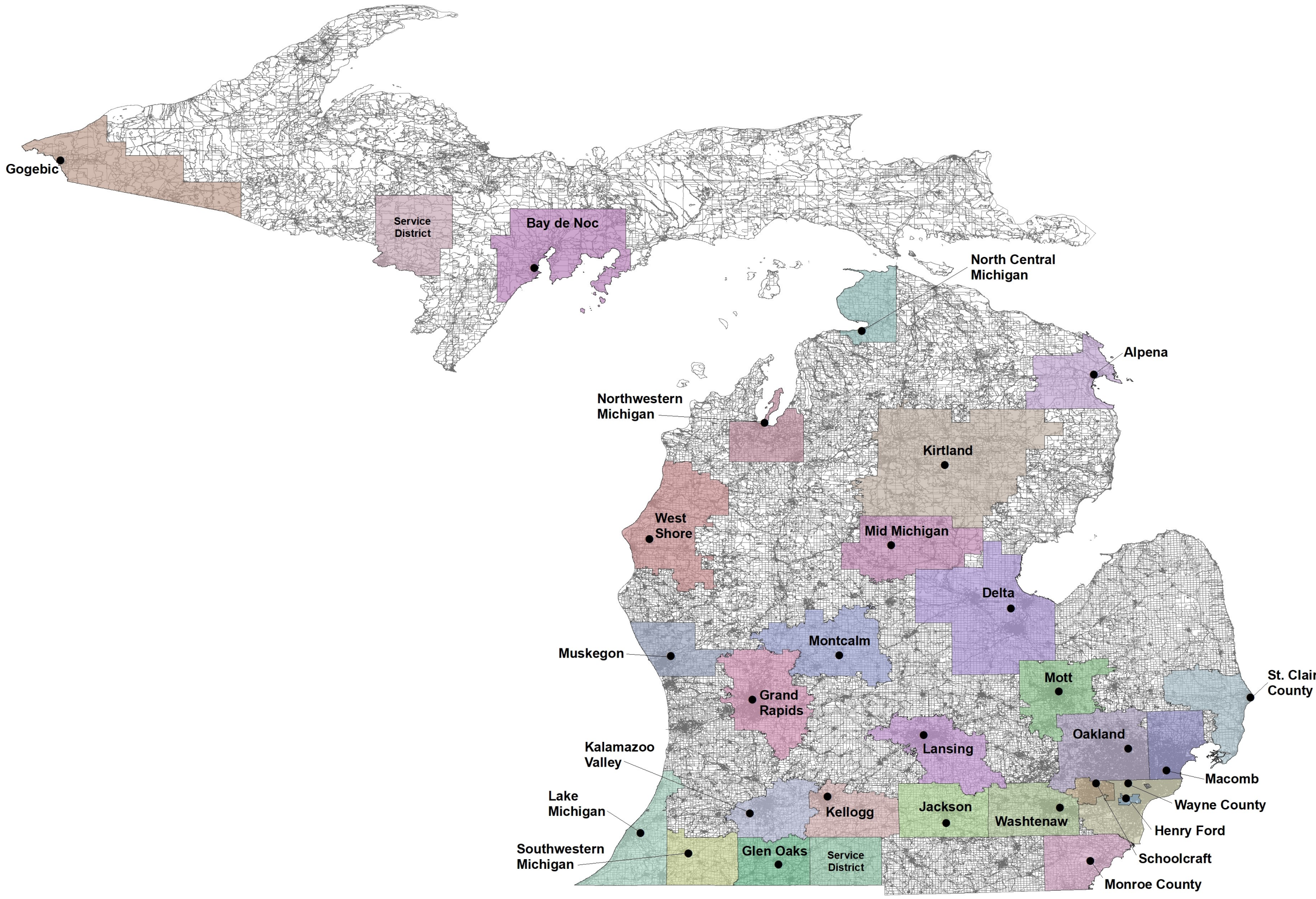

Figure 2: Michigan Census Blocks Mapped to Community College Districts

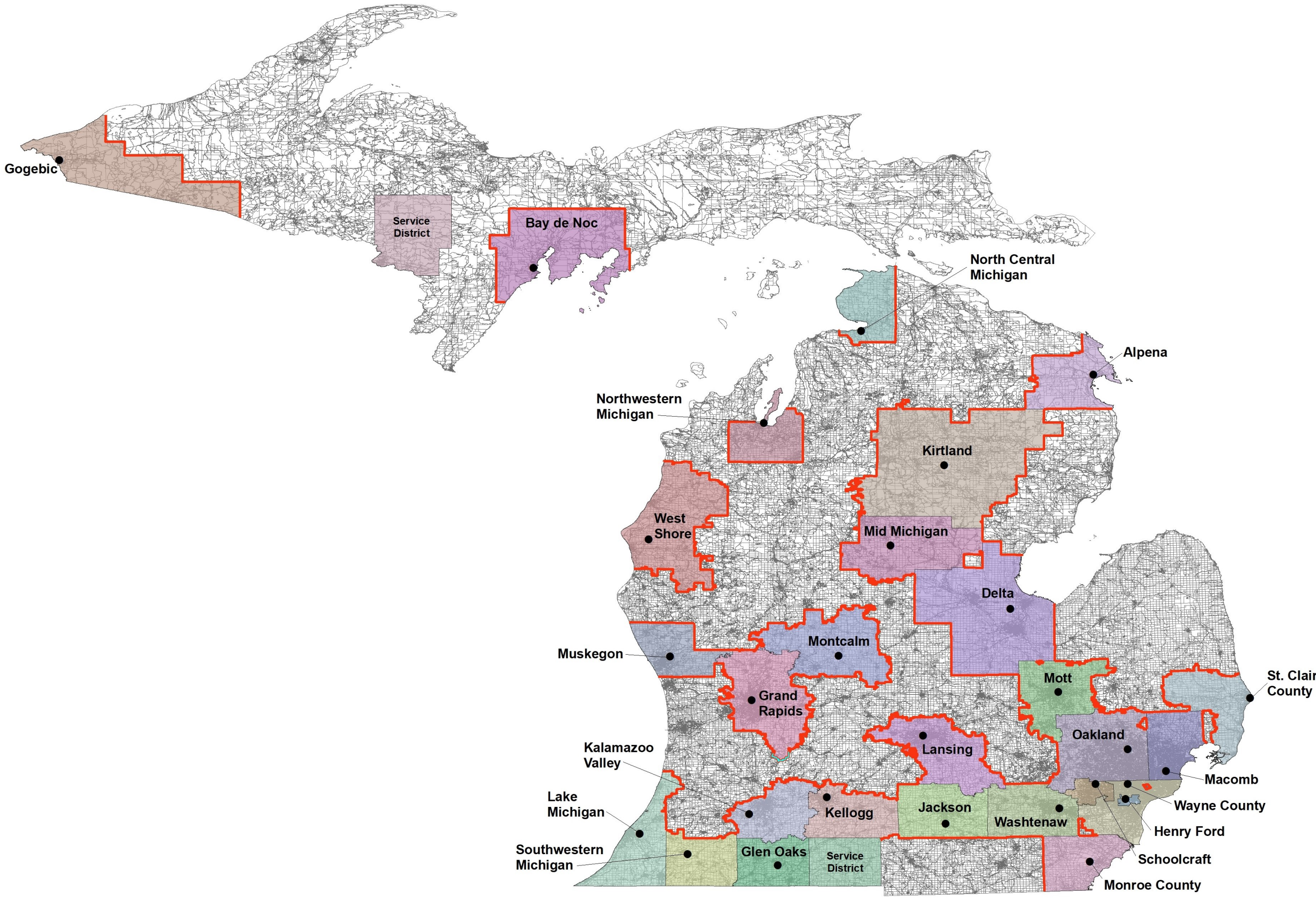

Figure 3: Identified Community College District Boundaries

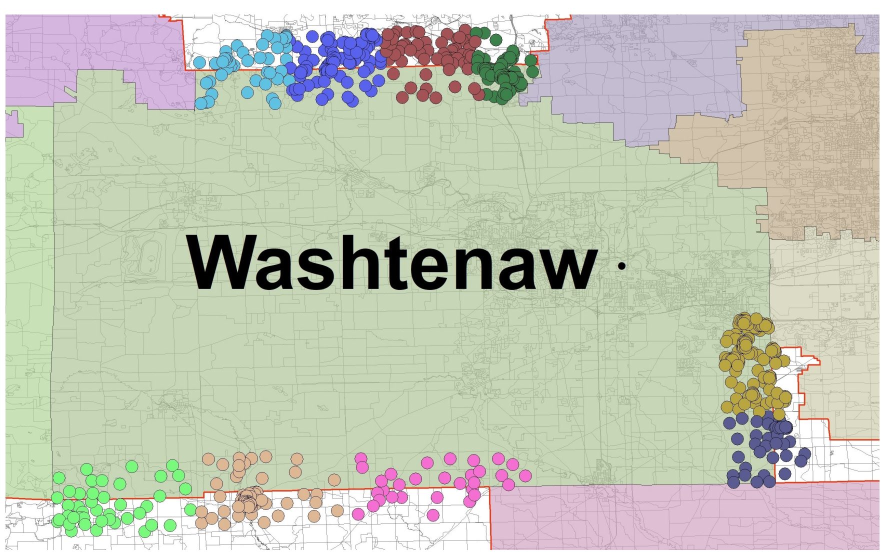

Figure 4: Washtenaw Community College District Analysis Sample

Table 1: Mean Tuition Rates at Michigan Community Colleges, 2008-2016

	Per Credit	**Per Semester**	**Per Year**	**Annual/Income**
In-District	\$94.44	\$1133.28	\$2266.56	3.78%
Out-of-District	\$155.39	\$1864.68	\$3729.36	6.22%
Difference	\$60.95	\$731.40	\$1462.80	2.44%

Notes: Tuition rates are provided by Michigan's Workforce Development Agency and converted into real 2016 dollars. All amounts are averaged across academic years 2008-2009 to 2015-2016. "Per semester" rates are calculated as the cost of 12 credits and "per year" rates are calculated as the cost per 24 credits. The final column "Annual/Income" presents the "per year" estimates divided by 60,000, the approximate median household income of students attending Michigan's community colleges (Chetty et al., 2017).

Table 2: Descriptive Statistics, 2009-2016 High School Graduates

Variable	**All Students**			**Analysis Sample**		
	All	**In**	**Out**	**All**	**In**	**Out**
Panel A. Demographics						
White	0.760	0.719	0.906	0.851	0.814	0.911
Black	0.150	0.189	0.015	0.081	0.110	0.034
Hispanic	0.041	0.041	0.043	0.029	0.029	0.030
Male	0.490	0.488	0.498	0.499	0.497	0.503
FRPL eligible	0.333	0.337	0.320	0.300	0.315	0.278
Special education	0.082	0.082	0.085	0.081	0.078	0.086
English language learner	0.025	0.030	0.010	0.021	0.029	0.007
Resides in CC district	0.779	1.000	0.000	0.616	1.000	0.000
Panel B. High School Academics						
Math standardized score	0.095	0.075	0.169	0.120	0.090	0.168
Reading standardized score	0.087	0.071	0.141	0.104	0.078	0.144
School of choice	0.096	0.094	0.104	0.124	0.120	0.130
On-time graduation	0.966	0.965	0.972	0.970	0.968	0.974
Dual enrollment in HS	0.095	0.088	0.121	0.108	0.102	0.117
Panel C. One-Year College Enrollment						
Community college	0.294	0.314	0.226	0.295	0.314	0.265
Vocational college	0.031	0.027	0.046	0.035	0.031	0.043
Four-year college	0.407	0.411	0.393	0.375	0.373	0.378
Any college	0.697	0.712	0.642	0.674	0.684	0.658
Observations	734,928	572,581	162,347	64,667	39,814	24,853

Notes: The "All Students" sample include all students who graduate from a traditional public high school in Michigan between 2009 and 2016, take the Michigan Merit Exam (MME), and have non-missing geographic and test score information. The "Analysis Sample" further restricts the sample to students who reside within two miles of a community college district boundary. Students who attend alternative education high schools or juvenile detention centers are not included in either sample.

Table 3: First Stage Estimate of In-District Status on Tuition

Variable	No Controls	Distance Controls	All Controls
District	-1,847*** (259.1)	-1,827*** (231.1)	-1,829*** (230.1)
N	64,667	64,667	64,667
Partial F	50.83	62.60	63.23
Adj. R2	0.910	0.914	0.915

Notes: Each coefficient is estimated from a single regression and corresponds to λ in equation (2), representing the difference in local community college tuition faced by students residing inside of a community college district, as compared to students residing outside of a community college district. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4: Balance Tests of Student Characteristics

Outcome	White (1)	Male (2)	FRPL (3)	SPED (4)	ELL (5)
District	0.001 (0.010)	-0.004 (0.005)	-0.015 (0.012)	-0.009*** (0.003)	0.006 (0.006)
Observations	64,667	64,667	64,667	64,667	64,667
Mean	0.851	0.499	0.300	0.081	0.021

Outcome	Math Score (6)	Reading Score (7)	On-Time Grad (8)	Dual Enroll (9)
District	0.012 (0.013)	0.015 (0.012)	-0.001 (0.003)	-0.008* (0.004)
Observations	64,667	64,667	64,667	64,667
Mean	0.120	0.104	0.970	0.108

Notes: Each coefficient is estimated from a single regression and corresponds to δ in equation (4). The coefficients represent the average difference in characteristics among students who reside within two miles of the same community college district boundary and graduate from high school in the same year. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5: Effect of In-District Status and Reduced Tuition on College Enrollment

Outcome	**Local CC (1)**	**Non-Local CC (2)**	**Vocational College (3)**	**Four-Year College (4)**	**Any College (5)**
Panel A. All Cohorts					
Policy Effect	0.064***	-0.028***	-0.007***	-0.010	0.013**
	(0.007)	(0.006)	(0.002)	(0.007)	(0.005)
Tuition Effect	0.035***	-0.015***	-0.004***	-0.005	0.007**
	(0.004)	(0.004)	(0.001)	(0.003)	(0.003)
Observations	64,667	64,667	64,667	64,667	64,667
Mean	0.209	0.089	0.035	0.375	0.674
Panel B. 2009-2011 Cohorts					
Policy Effect	0.060***	-0.035***	-0.007**	-0.005	0.006
	(0.010)	(0.007)	(0.003)	(0.008)	(0.008)
Tuition Effect	0.036***	-0.021***	-0.004***	-0.003	0.004
	(0.006)	(0.006)	(0.001)	(0.005)	(0.004)
Observations	23,734	23,734	23,734	23,734	23,734
Mean	0.225	0.096	0.040	0.368	0.691

Notes: The sample in Panel A consists of all students who reside within two miles of the nearest community college district boundary segment and graduated from high school between 2009 and 2016. Panel B further restricts the sample to students who graduated from high school between 2009 and 2011. In both panels, each coefficient is estimated from a single regression. The coefficients in the "policy effect" rows correspond to δ in equation (1), representing the estimated change in the probability of an outcome due to a student residing in a community college district. The coefficients in the "tuition effect" rows correspond to $-\beta * 1000$, where β is defined as in equation (3). These coefficients represent the estimate change in the probability of an outcome due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6: Effect of In-District Status and Reduced Tuition on Initial College Major

Outcome	**General Studies (1)**	**Liberal Arts (2)**	**Health (3)**	**Business (4)**	**Technical (5)**	**Prof. (6)**	**Other (7)**
Panel A. All Cohorts							
Policy Effect	0.016***	-0.008	0.001	0.001	-0.005	-0.009*	0.005
	(0.006)	(0.006)	(0.004)	(0.003)	(0.004)	(0.005)	(0.004)
Tuition Effect	0.009***	-0.004	0.002	0.000	-0.003	-0.005	0.003
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Observations	48,308	48,308	48,308	48,308	48,308	48,308	48,308
Mean	0.254	0.117	0.140	0.099	0.103	0.198	0.089
Panel B. 2009-2011 Cohorts							
Policy Effect	0.029***	-0.019***	-0.000	0.006	-0.007	-0.013	0.003
	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)
Tuition Effect	0.018***	-0.011***	-0.000	0.004	-0.004	-0.008	0.002
	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.005)
Observations	18,993	18,993	18,993	18,993	18,993	18,993	18,993
Mean	0.201	0.119	0.145	0.094	0.089	0.208	0.144

Notes: The sample in Panel A consists of all students who reside within two miles of the nearest community college district boundary segment, graduated from high school between 2009 and 2016, and enrolled in college at some point during the time frame of the data. Panel B further restricts the sample to students who graduated from high school between 2009 and 2011. In both panels, each coefficient is estimated from a single regression. The coefficients in the "policy effect" rows correspond to δ in equation (1), representing the estimated change in the probability of an outcome due to a student residing in a community college district. The coefficients in the "tuition effect" rows correspond to $-\beta * 1000$, where β is defined as in equation (3). These coefficients represent the estimate change in the probability of an outcome due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 7: Effect of In-District Status and Reduced Tuition on College Completion

Outcome	**Semesters of College (1)**	**CC to Four-Year Transfer (2)**	**Completed Certificate (3)**	**Completed Associate (4)**	**Completed Bachelor's (5)**
Policy Effect	0.344***	0.012**	-0.003	0.005	0.018**
	(0.097)	(0.005)	(0.004)	(0.005)	(0.008)
Tuition Effect	0.206***	0.007**	-0.002	0.003	0.011**
	(0.062)	(0.003)	(0.003)	(0.002)	(0.005)
Observations	23,734	23,734	23,734	23,734	23,734
Mean	8.133	0.108	0.055	0.126	0.316

Notes: The sample consists of all students who reside within two miles of the nearest community college district boundary segment and graduated from high school between 2009 and 2011. Each coefficient is estimated from a single regression. The coefficients in the "policy effect" rows correspond to δ in equation (1), representing the estimated change in the probability of an outcome due to a student residing in a community college district. The coefficients in the "tuition effect" rows correspond to $-\beta * 1000$, where β is defined as in equation (3). These coefficients represent the estimate change in the probability of an outcome due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 8: Distribution of Degree Completion Increases Across Majors

Outcome	General Studies (1)	Liberal Arts (2)	Health (3)	Business (4)	Technical (5)	Prof. (6)	Other (7)
Panel A. Associate Degree							
Policy Effect	0.010***	-0.000	-0.002	-0.002	-0.003	-0.001	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Tuition Effect	0.006***	-0.000	-0.001	-0.001	-0.002*	-0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Observations	23,734	23,734	23,734	23,734	23,734	23,734	23,734
Mean	0.035	0.008	0.022	0.014	0.011	0.022	0.014
Panel B. Bachelor's Degree							
Policy Effect	0.002*	-0.002	0.001	0.007*	-0.003	0.012***	0.001
	(0.001)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)
Tuition Effect	0.001*	-0.001	0.001	0.004*	-0.002	0.007***	0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	23,734	23,734	23,734	23,734	23,734	23,734	23,734
Mean	0.003	0.089	0.035	0.051	0.029	0.088	0.021

Notes: In both panels, the sample consists of all students who reside within two miles of the nearest community college district boundary segment and graduated from high school between 2009 and 2011. Each coefficient is estimated from a single regression. The coefficients in the "policy effect" rows correspond to δ in equation (1), representing the estimated change in the probability of an outcome due to a student residing in a community college district. The coefficients in the "tuition effect" rows correspond to $-\beta * 1000$, where β is defined as in equation (3). These coefficients represent the estimate change in the probability of an outcome due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 9: Heterogeneity by Student Characteristics

	One year enrollment:					Completion:	
Outcome	**Local** (1)	**Non-Local** (2)	**Voc.** (3)	**Four-Year** (4)	**Any** (5)	**Assoc.** (6)	**Bach.** (7)
Overall effect	0.064***	-0.028***	-0.007***	-0.010	0.013***	0.005	0.018**
	(0.007)	(0.006)	(0.002)	(0.007)	(0.005)	(0.005)	(0.008)
Panel A. FRPL eligibility							
Ineligible	0.067***	-0.033***	-0.007***	-0.010	0.010	0.006	0.015
	(0.008)	(0.007)	(0.002)	(0.008)	(0.006)	(0.005)	(0.009)
Eligible	0.056***	-0.015**	-0.009**	-0.008	0.019***	0.002	0.028**
	(0.009)	(0.006)	(0.003)	(0.008)	(0.007)	(0.009)	(0.013)
Ineligible = eligible?	0.244	0.026	0.647	0.859	0.312	0.686	0.436
Panel B. Gender							
Female	0.056***	-0.034***	-0.011***	-0.005	-0.001	0.004	0.019*
	(0.008)	(0.007)	(0.003)	(0.007)	(0.009)	(0.008)	(0.011)
Male	0.072***	-0.022***	-0.004*	-0.014*	0.026***	0.006	0.017*
	(0.008)	(0.008)	(0.002)	(0.008)	(0.007)	(0.006)	(0.010)
Female = male?	0.008	0.138	0.033	0.206	0.017	0.832	0.913
Panel C. Test score							
Bottom quartile	0.074***	-0.018**	-0.011***	-0.023**	0.021**	0.012	0.008
	(0.011)	(0.009)	(0.004)	(0.009)	(0.011)	(0.010)	(0.011)
Middle two quartiles	0.075***	-0.036***	-0.009***	-0.003	0.017***	-0.001	0.026**
	(0.008)	(0.007)	(0.003)	(0.007)	(0.007)	(0.007)	(0.011)
Top quartile	0.029***	-0.19**	0.001	-0.008	-0.004	0.011	0.014
	(0.010)	(0.008)	(0.003)	(0.015)	(0.008)	(0.0010)	(0.014)
Bottom = middle?	0.934	0.031	0.677	0.061	0.730	0.363	0.150
Top = middle?	0.000	0.017	0.022	0.702	0.029	0.288	0.488
N	64,667	64,667	64,667	64,667	64,667	23,734	23,734

Notes: For outcomes (1)-(5), the sample consists of all students who reside within two miles of the nearest community college district boundary segment, graduated from high school between 2009 and 2016. For outcomes (6) and (7), the sample is further restricted to students who graduated from high school between 2009 and 2011, and students who earn postsecondary degrees in high school are dropped from the sample. Coefficients are estimated from regressions with interaction terms, as described in section 5.4. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 10: Local Community College Enrollment Results, Within Same School District

	Local CC Enrollment		**Bachelor's Degree**	
	Main Strategy	**School District**	**Main Strategy**	**School District**
	(1)	**(2)**	**(3)**	**(4)**
Policy Effect	0.064***	0.050***	0.018**	0.015
	(0.007)	(0.014)	(0.008)	(0.022)
Tuition Effect	0.035***	0.032***	0.011**	0.011
	(0.004)	(0.011)	(0.005)	(0.015)
Observations	64,667	17,783	23,734	6,946
Mean	0.209	0.233	0.316	0.292

Notes: Columns (1) and (3) repeat the estimates for local community college enrollment and bachelor's degree completion presented in Tables 5 and 7, respectively. Columns (2) and (4) present reduced form and 2SLS estimates on the sample of school districts that overlap community college districts (see Section 5.5). In this column, standard errors are clustered at the school district level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 11: Placebo Tests

	Local CC Enrollment		**Bachelor's Degree**	
	Further In	**Further Out**	**Further In**	**Further Out**
	(1)	**(2)**	**(3)**	**(4)**
Estimate	0.005	0.007*	-0.012*	-0.004
	(0.007)	(0.004)	(0.007)	(0.008)
Observations	94,582	50,527	33,676	19,390
Mean	0.242	0.159	0.318	0.314

Notes: Each column reports the estimates of a placebo test that alters the boundaries of the community college districts. Columns (1) and (3) contract all community college districts by 2 miles; columns (2) and (4) expand all community college districts by 2 miles. Each column then estimates δ from equation (1) using the constructed placebo community college district boundaries. All standard errors are clustered at the placebo boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

A Online Appendix

A.1 Additional Figures and Tables

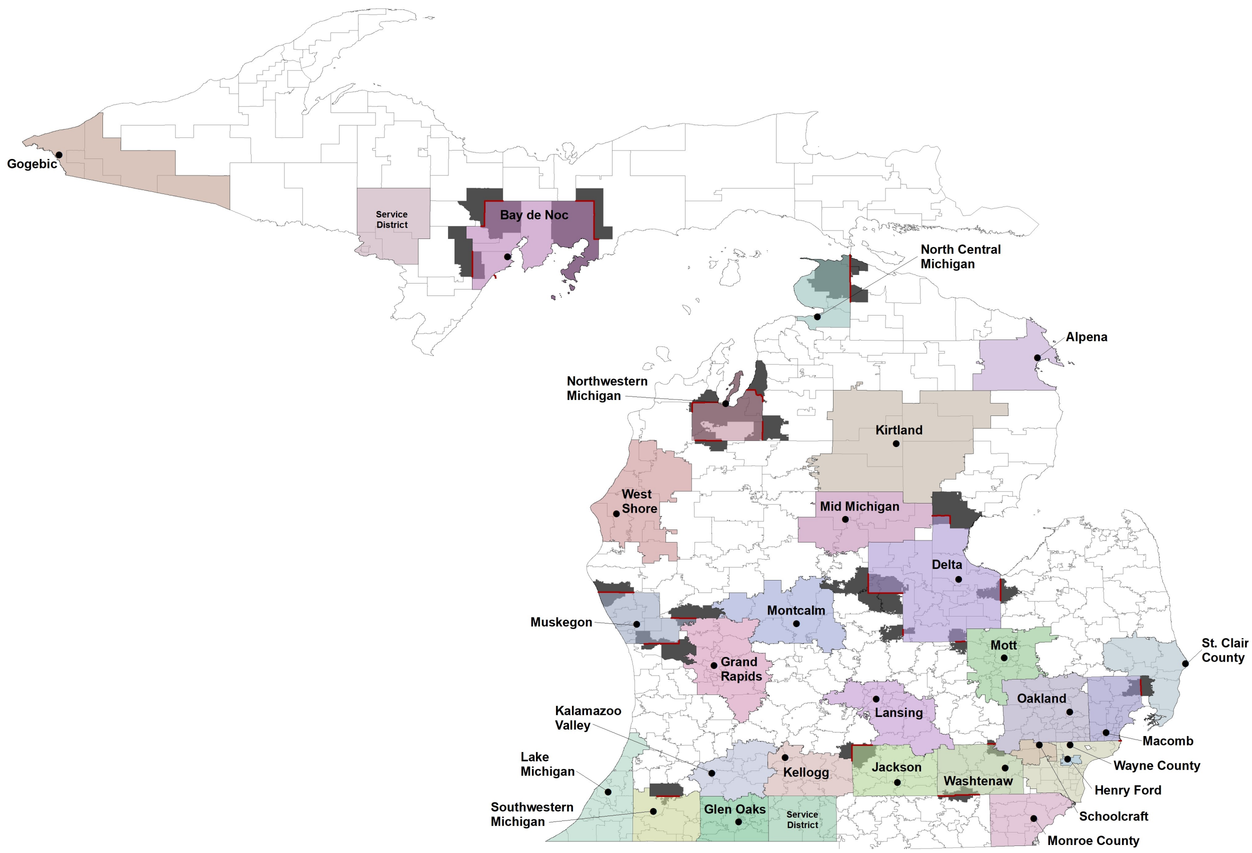

Figure A.1: School Districts Overlapping Community College Districts

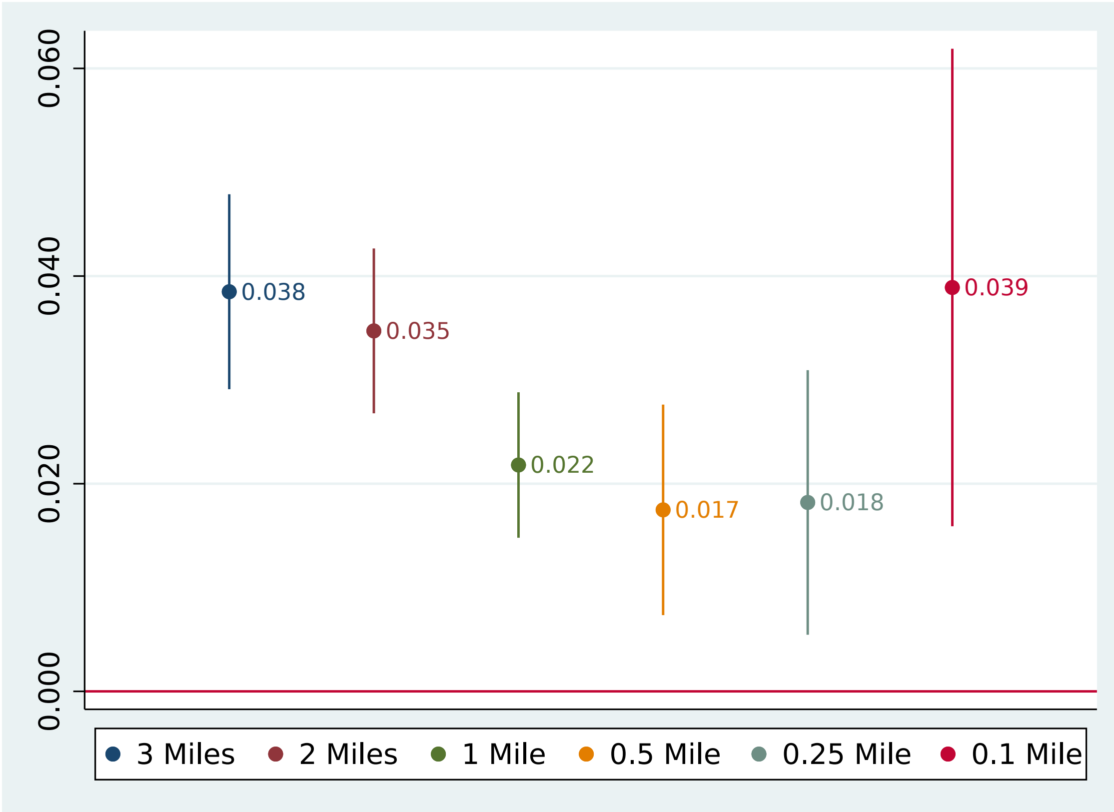

Figure A.2: IV Estimates with Alternative Bandwidths

Table A.1: Baker College vs. U.S. For-Profit Colleges

Variable	**Baker College**	**For-Profit**
% Associate Degrees	0.614	0.500
Tuition Rate	$7077	$13,608
Tuition Reliance	0.987	0.974
Tuition Discount	0.129	0.042
% Full-Time Students	0.520	0.382
Instruction per FTE	$3035	$3740
Faculty per 100 FTE	9.44	12.55
N	7	10,079

Notes: Data from The Delta Cost Project, 2008-2014.

Table A.2: Michigan's Traditional Four-Year Colleges

Variable	**Flagships**	**Other Public**	**Private**
Enrollment	45,263	13,633	2,079
Admissions Rate	0.554	0.748	0.662
Avg. In-State Tuition	$12,466	$9,104	$22,329
Instruction per FTE	$15,507	$7,119	$8,714
Faculty per 100 FTE	20.44	9.98	13.51
N	14	91	182

Notes: Data from The Delta Cost Project, 2008-2014.

Table A.3: Academic Program Categories

Category	Programs & CIP Codes
General Studies	Liberal arts and sciences, general studies, and humanities (24)
Liberal Arts	Multi/interdisciplinary studies (30); psychology (42); mathematics and statistics (27); English language and literature (23); biological and biomedical sciences (26); social sciences (45); foreign languages, literatures, and linguistics (16); history (54); area, ethnic, cultural, gender, and group studies (5); philosophy and religious studies (38)
Health	Health professions and related programs (51)
Business	Business, management, marketing, and related support services (52)
Technical	Engineering (14); engineering technologies and engineering-related fields (15); architecture and related services (4); science technologies/ technicians (41); mechanic and repair technologies/technicians (47); construction trades (46); precision production (48); transportation and materials moving (49)
Professional	Visual and performing arts (50), Computer and information sciences and support services (11); homeland security, law enforcement, firefighting, and related protective services (43); family and consumer sciences/human sciences (19); personal and culinary services (12); legal professions and studies (22); education (13); public administration and social services professions (44); communication, journalism, and related programs (9); communications technologies/technicians and support services (10); agriculture, agriculture operations, and related sciences (31); library science (25); natural resources and conservation (3)
Other	All CIP codes not included in above categories

Table A.4: Effect of In-District Status and Reduced Tuition on Initial College Quality

Outcome	**Total Enrollment (1)**	**Instruction per FTE (2)**	**Acad. Supp. per FTE (3)**	**Full-Time Faculty Share (4)**	**Graduation Rate (5)**
Policy Effect	-140.9	36.05	39.61	0.004	-0.004
	(307.4)	(88.36)	(29.61)	(0.003)	(0.005)
Tuition Effect	-84.44	21.61	23.74	0.003	-0.003
	(188.3)	(51.68)	(15.74)	(0.002)	(0.003)
Observations	18,676	18,676	18,676	18,676	18,676
Mean	19,300	7,511	2,030	0.348	0.356

Notes: The sample consists of all students who reside within two miles of the nearest community college boundary segment, graduated from high school between 2009 and 2011, enrolled in college at some point during the time frame of the data, and have non-missing data for all college quality measures in the Delta Cost Database. The coefficients in the "policy effect" rows correspond to δ in equation (3), representing the estimated change in the quality measure due to a student residing in a community college district. The coefficients in the "tuition effect" rows correspond to $-\beta * 1000$, where β is defined as in equation (4). These coefficients represent the estimate change in the quality measure due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A.5: School Districts Overlapping Community College Districts

School District	**Community College District**	**High Schools**
Bark River-Harris School District	Bay de Noc	1
Big Bay De Noc School District	Bay de Noc	1
Mid Peninsula School District	Bay de Noc	1
Ashley Community Schools	Delta	1
Breckenridge Community Schools	Delta	1
New Lothrop Area Public Schools	Delta	1
Reese Public Schools	Delta	1
Shepherd Public Schools	Delta	1
St. Louis Public Schools	Delta	1
Standish-Sterling Community Schools	Delta	1
Springport Public Schools	Jackson	1
Richmond Community Schools	Macomb	1
Coopersville Area Public School District	Muskegon	1
Fruitport Community Schools	Muskegon	1
Grant Public School District	Muskegon	1
Montague Area Public Schools	Muskegon	1
Mackinaw City Public Schools	North Central Michigan	1
Pellston Public Schools	North Central Michigan	1
Buckley Community Schools	Northwestern Michigan	1
Elk Rapids Schools	Northwestern Michigan	1
Forest Area Community Schools	Northwestern Michigan	1
Traverse City Area Public Schools	Northwestern Michigan	2
Decatur Public Schools	Southwestern Michigan	1
Clinton Community Schools	Washtenaw	1
Whitmore Lake Public School District	Washtenaw	1

Table A.6: Full Enrollment Results for Within Same School District Sample

Outcome	**Local CC (1)**	**Non-Local CC (2)**	**Vocational College (3)**	**Four-Year College (4)**	**Any College (5)**
Policy Effect	0.050***	-0.020*	-0.001	-0.016	0.014
	(0.014)	(0.012)	(0.005)	(0.018)	(0.016)
Tuition Effect	0.032***	-0.013	-0.001	-0.010	0.009
	(0.011)	(0.008)	(0.003)	(0.012)	(0.010)
Observations	17,783	17,783	17,783	17,783	17,783
Mean	0.233	0.067	0.035	0.336	0.643

Notes: The sample consists of all students who reside within a school district that intersects a community college district and graduated from high school between 2009 and 2016. Each coefficient is estimated from a single regression that includes a full set of school district by graduation year fixed effects. The coefficients in the "policy effect" represent the estimated change in the probability of an outcome due to a student residing in a community college district. The coefficients in the "tuition effect" row represent the estimate change in the probability of an outcome due to a $1,000 decrease in the annual tuition rate at a student's local community college. All standard errors are clustered at the boundary segment level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

A.2 Community College District Boundaries

* Denotes service area locale

Community College	Counties	School Districts	Cities/Townships
Alpena		Alpena	
Bay de Noc	Delta Dickinson*		
Delta	Bay Midland Saginaw		
Glen Oaks	Branch* St. Joseph		
Gogebic	Gogebic		
Grand Rapids		Kent ISD: Byron Center, Caledonia, Cedar Springs, Comstock Park, East Grand Rapids, Forest Hills, Godfrey Lee, Godwin Heights, Grand Rapids, Grandville, Kelloggsville, Kenowa Hills, Kent City, Kentwood, Lowell, Northview, Rockford, Sparta, Thornapple Kellogg, Wyoming	
Henry Ford		Dearborn	
Jackson	Jackson		
Kalamazoo Valley		Climax-Scotts, Comstock, Galesburg-Augusta, Gull Lake, Kalamazoo, Mattawan, Parchment, Portage, Schoolcraft, Vicksburg	
Kellogg		Albion, Athens, Battle Creek, Harper Creek, Homer, Lakeview, Mar-Lee, Marshall, Pennfield, Tekonsha, Union City	
Kirtland		C.O.O.R. ISD: Crawford-AuSable, Fairview Area, Houghton Lake, Mio-AuSable, Roscommon Area, West Branch-Rose City	
Lake Michigan	Berrien	South Haven	Covert
Lansing		Bath, Dansville, Dewitt, East Lansing, Grand Ledge, Haslett, Holt/Diamondale, Lansing, Leslie, Mason, Okemos, Stockbridge, Waverly, Webberville, Williamston	
Macomb	Macomb		
Mid Michigan		Clare-Gladwin RESA: Beaverton Clare, Farwell, Gladwin, Harrison	
Monroe County	Monroe		

Montcalm		Montcalm Area ISD: Carson City-Crystal, Central Montcalm, Greenville, Lakeview, Montabella, Tri County, Vestaburg	
Mott		Genesee ISD: Atherton, Beecher, Bendle, Bentley, Carman-Ainsworth, Clio, Davison, Fenton, Flint, Flushing, Genesee, Goodrich, Grand Blanc, Kearsley, Lake Fenton, Lakeville, Linden, Montrose, Mt. Morris, Swartz Creek, Westwood Heights	
Muskegon	Muskegon		
North Central Michigan	Emmet		
Northwestern Michigan	Grand Traverse		
Oakland	Oakland		
Schoolcraft		Clarenceville, Garden City, Livonia, Northville, Novi (part), Plymouth-Canton	
Southwestern Michigan	Cass		Keeler, Hamilton
St. Clair County		Algonac, Capac, East China, Marysville, Memphis, Port Huron, Yale	
Washtenaw	Washtenaw		
Wayne County	Wayne		NOT INCLUDED: Dearborn, Garden City, Highland Park, Livonia, Northville, Plymouth, Canton (part)
West Shore		Bear Lake, Free Soil, Kaleva-Norman-Dickson, Ludington, Manistee, Mason County Central, Mason County Eastern, Onekama, Walkerville	Crystal, Elbridge, Weare