The Impact of Public Tuition Subsidies on College Enrollment Decisions: Evidence from Michigan*

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Abstract

This paper examines the effects of public community college tuition subsidies on students’ postsecondary enrollment decisions. I exploit local policy variation in a boundary discontinuity framework and find that reducing tuition by $1,000 at a student’s local community college increases enrollment in the college by 3.5 percentage points. Approximately 30% of this increase may be attributed to students who would not have initially enrolled in any postsecondary option in the absence of the subsidy. An additional 52% of the increase is due to students shifting enrollment within the two-year college sector, including a reduction in enrollment in private vocational colleges. I provide suggestive evidence that this substitution effect may have implications for the quality of collegiate education students receive.

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1 Introduction

Community colleges play an important, but often overlooked, role in the United States’ postsecondary education system. These institutions offer a variety of educational programs, including vocationally focused certificates, two-year associate degrees, and transfer opportunities, at a lower price than nearly all other postsecondary options, making them accessible to a large and diverse group of students. Indeed, during the 2013-2014 academic year, nearly 10 million undergraduates enrolled at community colleges nationwide (National Center for Education Statistics, 2015). Moreover, community colleges have the opportunity to dramatically affect students’ long-term educational and economic outcomes. Approximately half of all bachelor degree recipients enrolled in a community college at one point during their academic careers (National Student Clearinghouse Research Center, 2017b), and select community colleges are more successful than top-tier research universities in fostering the upward economic mobility of their students (Chetty et al., 2017). In recent years, community colleges have become the focus of many local and national education policy initiatives, including programs that make community college tuition-free for nearly all students in Oregon and Tennessee (Smith, 2017).

As these types of programs grow in popularity, so too do questions about their potential consequences for students’ educational attainment. Policymakers and researchers alike have expressed concern that reducing the price of community college may cause students to shift their enrollment from four-year colleges to community colleges, potentially decreasing the probability that they earn a bachelor’s degree and receive its premium 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 two-year colleges - 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

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1 Throughout this paper, I use the term “community college” to refer to any publicly funded college that primarily offers sub-baccalaureate degrees and certificates. These institutions are also sometimes referred to as junior colleges, technical colleges, or city colleges.
certificates and nearly 20% of associate degrees in the U.S., despite having higher average tuition rates and worse average completion rates and labor market outcomes than their public, not-for-profit counterparts (Deming et al., 2012; Cellini, 2012; Deming et al., 2016). If students respond to reduced community college tuition by forgoing enrollment in these vocational colleges, it could have a positive effect on students’ educational attainment and labor market outcomes. Similarly, offering reduced tuition at select community colleges - for example, at a student’s local community college - could deter students from attending other, lower quality community colleges. This is an important mechanism to consider given the heterogeneity in institutional expenditures, completion rates, and labor market outcomes between community colleges.

In this paper, I provide evidence on the effects of publicly subsidizing the tuition rate at a student’s local community college. I consider how a change in price affects a student’s decision to enroll in their local community college, in other community colleges, in vocational colleges, and in four-year colleges, as well as how these enrollment effects may impact the quality of collegiate education that students receive. Historically, analyses of this type have been difficult for two reasons. First, identifying the causal effect of community college tuition on enrollment decisions requires an exogenous source of variation in tuition rates, which can be difficult to find when relying on cross-state or time series variation. Recent work uses the expansion of place-based discounted community college programs to estimate students’ responsiveness to changes in community college tuition. For example, Denning (2017) estimates how community college enrollment changes when a local community college tuition subsidy is expanded to new school districts in Texas. Here, I exploit a similar institutional feature of Michigan’s community college system, in which students residing on either side of a geographic boundary face substantially different tuition rates at their local community college. Second, data limitations have prevented previous researchers from

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2For example, in Michigan during the 2014-2015 academic year, instructional expenditures per student at community colleges ranged from $3337 to $9084 and completion rates ranged from 6% to 39% (American Institutes for Research, 2015).
examining the effects of public colleges’ tuition rates on students’ decisions to enroll in private colleges as many state-level datasets do not include private college enrollment records, or only include records for institutions within the state. I overcome this challenge by using administrative data that is linked to college records from the National Student Clearinghouse, which covers enrollment at the majority of public and private institutions across the United States, including a large number of for-profit colleges. This dataset allows me to consider both the full set of cross-price responses induced by a change in local community college tuition, which has not been considered in previous research and is critical for understanding both the short- and long-term effects of such a policy.

My results indicate that reducing the tuition rate that a student faces at their local community college by $1,000 increases initial enrollment at the college following high school graduation by 3.5 percentage points. I further decompose this enrollment effect into several underlying mechanisms. Approximately 30% of the increase can be attributed to students enrolling in their local community college who would not have initially enrolled in any post-secondary education program in the absence of the subsidy. An additional 37% can be attributed to students switching their enrollment between in-state community college options, and 15% of the increase is due to students forgoing enrollment in vocational colleges. I do not find strong evidence that students forgo attending four-year colleges in favor of their local community college. To my knowledge, the results regarding students forgoing vocational college enrollment have not been identified in prior studies of community college costs. In addition, I find suggestive evidence that this changes in enrollment behavior may affect the quality of collegiate education students receive, as, on average, a student’s local community college spends more per student on instruction and academic support than commonly attended vocational colleges.

3This is potentially problematic as many of the largest providers of vocational education are multi-state institutions which have a large online presence (e.g. University of Phoenix, Everest Institute).

4In this paper, I only consider college enrollments that occur within the first six months following a student’s graduation from high school. It may be the case that discounted tuition has different effects for students who choose to enroll in college at a later date.
The paper proceeds as follows. Section 2 presents a conceptual framework for the research question at hand and reviews the related previous literature. Section 3 provides institutional details on Michigan’s postsecondary education market, including the institutional feature I use in my identification strategy, and Section 4 outlines the boundary discontinuity research design. Section 5 summarizes the data and Section 6 formally describes the empirical strategy. Section 7 presents and discusses the results, and Section 8 concludes.

## 2 Conceptual Framework

Upon graduating from high school, students are faced with many postsecondary choices. For illustration, I group these choices into five exhaustive and mutually exclusive categories. First, students may choose to enter the labor market without pursuing any formal postsecondary education. Second, students may choose to enroll in their local community college: the public two-year institution that is closest to their place of residence and is designed to serve their community. Third, students may choose to enroll in a non-local community college, either within or outside their state of residence. Fourth, students may choose to enroll in a vocational college: the private counterpart of a community college that also offers sub-baccalaureate academic programs. Fifth, students may choose to enroll in either a public or private four-year college. In this paper, I will consider how a change in the cost of a student’s local community college due to a publicly provided tuition subsidy affects students’ decisions to enroll in each of these five postsecondary options.

Standard economic theory predicts that, all else equal, a decrease in the cost of a postsecondary option will increase the probability that a student chooses to pursue it. This is also the conclusion of a long line of empirical studies on the effects of college costs on enrollment decisions. Most previous analyses find a 2-4 percentage point increase in the probability of enrollment for each $1,000 decrease in the cost of a college option. Recent papers that explore the effects of community college tuition rates suggest that this effect may be even

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5See [Page and Scott-Clayton (2016)] for a review of the existing literature.
larger at the two-year college level. In their analysis of the Knox Achieves program, Car-
ruthers and Fox (2016) find that offering tuition-free community college alongside mentoring
increases community college enrollment rates by 3-5 percentage points among eligible high
school cohorts, and Denning (2017) finds that, in Texas, a $1,000 decrease in community
college tuition increases the probability of community college enrollment by approximately
5 percentage points.

However, because the postsecondary options I outline are both exhaustive and mutually
exclusive, any increase in the probability of enrolling at one’s local community college due
to a change in its cost must be offset by a decrease in the probability of selecting one of the
alternative choices. Let $\Delta L$ represent the change in the probability of local community col-
lege enrollment, $\Delta C$ represent the change in the probability of non-local community college
enrollment, $\Delta V$ represent the change in the probability of vocational college enrollment, and
$\Delta F$ represent the change in the probability of four-year college enrollment when a student’s
local community college tuition rate is reduced. Further let $\Delta N$ represent the change in the
probability of not enrolling in any college and instead entering the labor market. Then, by
basic properties of probability:

$$\Delta N = -\Delta L - \Delta C - \Delta V - \Delta F. \quad (1)$$

Equivalently,

$$\Delta L = -(\Delta N + \Delta F + \Delta C + \Delta V). \quad (2)$$

That is, the increase in enrollment in the local community college is exactly offset by the
sum of decreases in enrollment in other postsecondary options. Throughout this paper, I
will refer to $\Delta L$ as the policy effect, as it represents the increase in local community college
enrollment that results due to subsidy policy. I will refer to $-\Delta N$ as the participation effect,

$^6$Note that $-\Delta N$ represents the change in the probability of enrolling in any college.
as it captures how the subsidy promotes overall college enrollment, and I will refer to $\Delta F$ as the *between-sector effect* because it represents how students switch enrollment between the four-year and two-year college sectors when offered the subsidized tuition rate. Since non-local community college and vocational colleges are both two-year college options, it is occasionally useful to consider $\Delta V + \Delta C$, which is equivalent to the change in enrollment in two-year college options other than the local community college. I will refer to this as the *within-sector effect*. The goal of my analysis is to identify the policy effect and decompose it into these underlying substitution effects, as each effect may have different implications for students’ educational attainment and labor market outcomes.

The participation effect should increase students’ educational attainment, and should ultimately improve their labor market outcomes, so long as they persist in postsecondary education after enrolling. One potential concern is that, because community college is generally offered to students at a low cost without a tuition subsidy, the students induced to attend a community college under a discount may be unobservably different than students who choose to attend community college without a discount. For example, they may have a lower taste for community college education or may be less academically prepared for the rigors of college-level work than their peers who choose to attend community college both when it is discounted and when it is not. This phenomenon is not particularly well-studied within the community college literature, but [Denning (2017)](https://doi.org/10.3386/w23496) provides evidence that the students induced to attend community college under Texas’ expansion of community college taxing districts are not substantially different than their peers who attend prior to the expansion. The students who are induced to enroll in community colleges when they are offered a tuition discount tend to transfer to four-year universities and earn postsecondary credentials at roughly the same rate as their peers who enrolled prior to the discount being offered. This implies that the participation effect is likely to increase educational attainment, and in turn, should provide returns to students in the labor market.

The within-sector effect measures students’ willingness to shift their enrollment between
institutions that offer sub-baccalaureate programs, and may work to either increase or decrease students’ educational attainment. The direction of the effect will be determined by the relative quality of a student’s local community college, as compared to other two-year colleges, as well as the strength of the effect of two-year college quality on educational outcomes. To my knowledge, previous studies of community college costs have not considered this mechanism. However, there is evidence that other changes in college costs may positively affect the quality of college students attend. For example, some four-year merit aid programs, such as the Georgia HOPE Scholarship and the Tennessee Education Lottery Scholarship, are able to increase the quality of college a student attends (Bruce and Carruthers, 2014; Chakrabarti and Roy, 2013). I hypothesize that a similar effect may be present within the two-year college sector due to the increasing prevalence of low-quality vocational colleges who appear to compete with community colleges for students (Cellini, 2009). Whether or not this phenomenon has a causal effect on outcomes is less certain, as previous work finds that community college quality may not impact students’ educational attainment (Stange, 2012) and there is little evidence on how vocational college quality affects outcomes. The focus of this paper will be establishing whether a reduction in local community college cost changes students’ enrollment in other two-year colleges and, if so, to what extent it increases the quality of two-year institutions students attend. I will leave the determination of the causal effect of two-year college quality to future work.

The between-sector effect assesses students’ willingness to postpone or forgo four-year postsecondary education in favor of two-year postsecondary education. Due to the concern that this change in enrollment may harm students’ longer-run outcomes, several previous analyses of community college costs focus on this effect. Rouse (1995) first coined this phenomenon as the “diversion effect” and more recent papers find some evidence of it, at least for certain subgroups of students, such as African-American men (Denning, 2017; Carruthers and Fox, 2016). However, these works do not explicitly consider how the between-sector effect impacts the quality of education students receive, nor how it alters their long-term
educational attainment and labor market success. This is a key mechanism to consider as related work finds that relatively small changes in college costs may adversely affect the quality of college students attend, and in turn, their educational outcomes. For example, Cohodes and Goodman (2014) show that students who receive a small amount of merit aid under Massachusetts’ Adams Scholarship are willing to forgo substantial college quality, as measured by institutional spending and graduation rates, by attending lower quality public institutions rather than higher quality private ones. This behavior causes a reduction in both the probability that a student graduates from college and, conditional on graduating, lengthens the time until they earn a degree. In addition, Goodman et al. (2017) provide evidence that, for low-skilled students, gaining access to four-year public colleges via surpassing an admissions threshold significantly increases bachelor degree completion rates. The converse may occur if students are willing to forgo attending a four-year institution in favor of their local community college when the community college’s tuition rate is reduced. As such, I will seek to identify whether there is a meaningful between-sector enrollment effect and, if so, how this effect influences the quality of college students attend.

To summarize, both economic theory and previous empirical evidence suggest that reducing a student’s cost of attending their local community college should increase the probability that she attends the college. However, it is not clear ex-ante whether this will necessarily increase educational attainment. This is because there are two channels through which an increase in the probability of local community college enrollment may impact longer-run outcomes. First, an increase in the probability of local community college enrollment may increase the probability that a student attends any postsecondary institution. This is expressed by the participation effect and should increase educational attainment, so long as the students who are induced to enroll are able to successfully complete academic programs. Second, conditional on enrolling in postsecondary education, the reduction in cost can change the quality of institution a student attends, which may increase or decrease educational attainment via the within-sector or between-sector effects. The goals of this paper are to (1)
decompose the enrollment response to a change in local community college price in order to identify underlying substitution effects and (2) provide evidence on how the substitution effects may impact the quality of collegiate education students receive.

3 Institutional Details

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, and over 90% of the state’s high school graduates who enroll in college choose to attend one of them. The institutions vary substantially in their program offerings, tuition rates, expenditures, and missions, and a full overview of the state’s postsecondary offerings is beyond the scope of this paper. However, 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 boundary. Second, Michigan has multiple large, private vocational colleges that offer associate degrees and sub-baccalaureate certificates similar to those offered at community colleges, but which differ from community colleges and four-year colleges in their prices and measures of institutional quality. This allows me to both examine whether reducing the price of a public two-year college crowds out enrollment in similar private colleges, and to estimate how a change in local community college tuition affects the quality of institution a student attends. In this section, I provide further details of these features and outline the postsecondary choices available to Michigan’s high school graduates.
3.1 Community Colleges

Michigan is home to 28 public community colleges which enroll a total of 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 operation of community colleges and state intervention in their practices is rare (Hilliard, 2016). These colleges serve a wide range of purposes for a diverse student body. They offer a mix of collegiate and non-collegiate level educational programming, including vocational and technical certificates and associate degrees, general education courses designed to assist students in transferring to four-year universities, training programs for displaced workers, and non-credit courses for members of their local communities (House Fiscal Agency, 2017a). As of 2012, the state’s community colleges may also offer bachelor degree programs in cement technology, maritime technology, energy production technology, and culinary arts (Fain, 2013). In total, Michigan’s community colleges currently offer 2,610 degree and certificate programs, of which 1,357 are associate’s degrees and 1,251 are certificate programs. During the 2013-2014 academic year, these institutions conferred more than 26,000 associate degrees and 10,000 certificates in over 300 fields of study. An additional 20,000 students transferred from Michigan’s public community colleges to the state’s four-year public universities during the 2014-2015 academic year (Michigan Community College Association, 2017).

The demographic makeup of Michigan’s community colleges mirrors the diversity of their educational offerings. Of the more than 400,000 students who enroll in the state’s public two-year colleges each year, approximately two-thirds enroll part time and just over half enter into certificate or degree programs; the remainder choose to enroll in courses or training programs without working towards a specific credential. The average age of students is 25.7, which is significantly higher than the average age at four-year institutions, and minority students make up nearly 28% of enrollment across the state, compared to 20% of Michigan’s
population overall (U.S. Census Bureau, 2017). From national trends, the state estimates that a large proportion of their community college students are the first in their families to pursue postsecondary education and that many face additional constraints, such as parenting and work responsibilities, that may affect their academic outcomes (Michigan Community College Association, 2017).

In order to serve their students, Michigan’s community colleges primarily rely on three funding sources for operational expenditures: state appropriations (20%), tuition and fees (43%), and local property taxes (35%). For each college, local property taxes may only be assessed on properties within its community college district (House Fiscal Agency, 2017a). Community college district boundaries may be set by the trustees of each college under state guidelines and can be made up of counties, public school districts, public intermediate school districts (ISDs), cities, townships, or any combination of these geographic features. Currently, approximately 43% of districts are made up of counties, 36% are made up of school districts or ISDs, and 21% are made up of a combination of multiple features. 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 the community college district boundaries. In exchange for property tax funding, students residing within the boundaries of a district are offered the lowest tuition rate, averaging approximately $90 per credit. Students residing within Michigan, but outside of the district, are offered the next lowest rate, and students residing outside of the state are offered the highest rate. Critically for my analysis, a non-trivial portion of students reside outside of

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7 Based on conversations with state officials and community college staff members, it is my understanding that no community college boundaries changed during the time frame of my data, and that most have remained unchanged for several decades.

8 The tuition prices used in this paper are the listed 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.

9 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.
any community college district. I estimate that 34% of high schools are located outside of community college districts and that 22% of students reside in an area that is not specifically served by any community college. On average, these students face tuition rates at their local community college that are 65% higher than those faced by their peers who live within community college district boundaries. This equates to an average annual cost difference of nearly $1,500. Given that the annual median family income of Michigan community college students is approximately $60,000, this represents a difference of approximately 2.5% of annual median family income (Chetty et al., 2017). Table 1 provides summary statistics on the average tuition rates between 2008 and 2016, measured in 2016 dollars.10

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 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 change these rates annually. Over the time frame of the data, 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 and 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. Notably, the mean in-district and out-of-district tuition distributions overlap and, 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. Figure 2 plots these averages, again measured in 2016 dollars, for the time frame of the data. The widening gap between the two

10Following the previous literature (e.g. Denning, 2017), semester cost is calculated as the cost of 12 credits and annual cost is calculated as the cost of 24 credits.
lines indicates that out-of-district students have faced increasingly high tuition rates relative to their in-district peers over the 2008-2016 time period.

3.2 Vocational Colleges

In this paper, I define a vocational college as a private institution that fits one or more of the following criteria: (1) it is a for-profit institution, (2) more than 25% of its degrees are awarded at the associate level, or (3) it has an open enrollment admissions policy. In Michigan, the colleges identified under this criteria and available in my data sources are: Baker College (not-for-profit), Davenport University (not-for-profit), Everest Institute (for-profit), Finlandia University (not-for-profit), Great Lakes Christian College (not-for-profit), ITT Technical Institute (for-profit), and The International Academy of Design & Technology (for-profit). The largest of these institutions is Baker College, which has thirteen locations throughout the state, enrolls over 25,000 students annually, and makes up over 90% of total enrollment within the state’s vocational colleges.

Baker is a unique institution in that it is private and primarily offers sub-baccalaureate credentials, but operates as a not-for-profit entity. However, in many ways, it operates similarly to the more popular model of a private, for-profit college that offers two-year or less degrees and certificates. 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,

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11 It should be noted that the three for-profit colleges in this list shut down operations within Michigan during the time frame of my data. However, I still include them in my analysis since they were plausibly in the choice set of graduating high school students during the years they were open.
the results from this paper should provide evidence on how reductions in local community college tuition may affect enrollment at for-profit vocational colleges, in addition to not-for-profit ones.

3.3 Four-Year Colleges

The remainder of undergraduate, degree-granting postsecondary institutions in Michigan are either public or private four-year colleges. On the public side, Michigan boasts two flagship research universities, the University of Michigan-Ann Arbor and Michigan State University, and thirteen smaller 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 (House Fiscal Agency, 2017b). 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. However, in contrast to community colleges, 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. Appendix Table A.2 provides summary statistics on these institutional attributes.

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 also provides summary statistics on these institutions’ key characteristics.
3.4 Low Skill Labor Market

A final postsecondary option remains for students who choose not to enroll in community, vocational, or four-year colleges: the low-skill labor market. 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 \[\text{ (Bureau of Labor Market Information and Strategic Initiatives, 2014).}\] A small number of high school graduates are also able to secure on-the-job training opportunities, such as apprenticeships, in lieu of formal postsecondary education. However, only about 5,000 individuals begin such programs each year, making it a relatively small component of the postsecondary education market \[\text{ (Bureau of Labor Market Information and Strategic Initiatives, 2016).}\]

4 Research Design & Sample Construction

The goal of this paper is to estimate the causal effect of facing a reduced tuition price at the local community college on a student’s postsecondary enrollment decision by exploiting the fact that students who live inside a community college district boundary face a substantially discounted tuition rate at the local community college, as compared to their peers who live outside of the boundary. The challenge of this approach in my institutional setting is that students who face different community college tuition rates due to their place of residence relative to community college district boundaries may also differ in both observable and unobservable characteristics that affect postsecondary choices. Observable differences may be tested for in the data and controlled for in the empirical specifications, but unobservable differences may bias my results. For example, if families with a high unobserved

\[\text{For example, in 2013, the state’s median wage for food preparation and serving occupations was } \$9.02/\text{hour and the median wage for sales occupations was } \$11.98/\text{hour (Bureau of Labor Market Information and Strategic Initiatives, 2014).}\]
taste for community college education differentially choose to live within community college
districts, my estimates will overstate the effect of facing reduced tuition. Similarly, if stu-
dents who reside within a community college district have more information about the local
community college than their out-of-district peers, my results may not be driven solely by
differences in tuition rates. To mitigate this type of bias, I use a variation of a boundary
 discontinuity design where I isolate my analysis to students who attend public high schools
that are located just inside and just outside of community college district boundaries. I then
create small groupings of high schools in nearby in-district and out-of-district public school
districts and use a fixed effects strategy in order to control for unobservable factors that
differentially affect narrow geographic areas. In this section, I describe the construction of
my analysis sample and the intuition of my research design.

The first step in constructing my analysis sample is to identify public school districts that
are located within community college districts. To do so, I gather information on community
college district boundaries from individual community college websites, course catalogs, and
conversations with colleges’ institutional research staff. I then use this information to
assign public school districts to community college districts. For community college districts
made up exclusively of public school districts or ISDs, this is straightforward: I assign a
school district to the given community college district if it is part of a school district or ISD
that is included in the community college district. For community college districts made up
of counties, I assign a school district to the community college district if its official address is
within one of the counties included in the community college district. For community college
districts made up of multiple geographic features, I similarly assign a school district to the
community college district if its official address is within one of the features included in the
community college district. Figure 3 displays the boundaries created by this assignment
algorithm along with the location of each community college’s main campus.

13 Appendix Table A.2 lists the geographic areas that comprise each community college district.
14 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 these areas in my analysis.
Next, I restrict my sample to high schools within “boundary school districts” which are located on either side of a community college district boundary. That is, they are either (1) located within a community college district and share a boundary with a public school district that is not in a community college district or (2) not located within a community college district and share a boundary with a school district that is in a community college district. This limits the sample to public high schools that are located in public school districts that are either just inside or just outside of a community college district. Figure 4 identifies these districts in the Lansing Community College Area. School districts shown in light blue are not boundary school districts because they are within the community college district and are completely surrounded by school districts that are also within the community college district. Thus, they cannot be used in the boundary discontinuity framework. School districts shown in dark green are in-district boundary school districts and school districts shown in light green are out-of-district boundary school districts.

I then match each school in an in-district boundary school district to the nearest school in an out-of-district boundary school district in the surrounding geographic area of a community college. This creates pairings of nearby high schools that differ in their in-district status and, correspondingly, the tuition rates their students are likely to face at the local community college. Pairings where the in-district and out-of-district paired high schools differ in their nearest community college are excluded from the analysis, so that the community college at which in-district students receive subsidized tuition is also the nearest community college for the students in the paired out-of-district school district. Therefore, I define the “local community college” for in-district high schools as the community college at which graduates are likely to receive in-district tuition and for out-of-district high schools as the geographically closest community college option. All other community colleges are considered “non-local community colleges” for my analysis.

Occasionally, two or more schools within in-district boundary districts are paired with the same school in an out-of-district boundary district. In these cases, I combine the pairings
to create groupings with three or more schools in which one school serves as the common out-of-district counterpart. Figure 5 identifies these pairings and groupings for the largest high school in each school district in the Lansing Community College area. School districts shown in the same color are grouped together, with the school districts shown in the dark shade of the color representing in-district status and school districts shown in the light shade of the color representing out-of-district status. For example, the high schools of Laingsburg, Bath, and Haslett make up a grouping. Laingsburg is outside of Lansing Community College’s district, whereas Bath and Haslett are both within it.

As evident from Figure 5, schools within a grouping may still be a substantial distance away from one another. This may cause the students in the paired schools to have different unobservable characteristics and may raise concerns about the validity of using the paired out-of-district schools as control observations for the in-district schools. To reduce this potential source of bias, I further restrict the sample to groupings in which the high schools are no more than 10 miles apart. I also exclude high schools whose students are eligible for significant discounts at other colleges and universities via promise scholarship programs or individual institution partnerships, and only include schools that remained open continuously between 2008 and 2016. Figure 6 identifies these final groupings included in the analysis sample in the Lansing Community College area. There are three groupings included in the sample from this area: Bath (in-district) and Laingsburg (out-of-district), Williamston (in-district) and Perry (out-of-district), and Webberville (in-district) and Fowlerville (out-of-district). Figure 7 identifies all school districts in the state that are included in the analysis sample. School districts displayed in white contain no high schools that are included in the sample, while school districts displayed in a color contain at least one high school that is included in the sample. School districts of the same color contain high schools that are members of the same grouping.

\[15\] In this example, each school district contains exactly one high school. This is the case for the majority of school districts included in the sample.

\[16\] For example, Olivet College offers a significantly reduced tuition rate to graduates of local high schools.
Intuitively, the empirical strategy compares the outcomes of graduates in a cohort at a high school in the “dark shade” school districts in Figure 6 to the outcomes of graduates in the same cohort at a high school in the “light shade” school districts within a given color, after controlling for observable characteristics of the school and cohort that may affect postsecondary outcomes. The key identifying assumption is that, after controlling for observable characteristics that may affect postsecondary outcomes, the differing in-district and out-of-district statuses of the high schools in “dark shade” and “light shade” school districts is uncorrelated with unobservable determinants of postsecondary outcomes. Given the limited state oversight in the designation of community college district boundaries, and the lack of public information available about them, I believe this is a reasonable assumption. This strategy and the corresponding assumptions are presented formally in Section 6, after a brief description of the paper’s data in Section 5.

5 Data Sources

The data used in this paper come from several sources. I obtain academic indicators, demographic variables, and postsecondary outcomes for the graduating cohorts of 2008-2016 from all Michigan public high schools from the state’s Center for Educational Performance and Information (CEPI). These data are available at the school-cohort level and selected variables are disaggregated by race and gender. I match these data to street addresses, along with latitude and longitude information, on all Michigan public schools from the state’s Education Entity Master database (EEM). I further obtain postsecondary institutional information, including the latitudes and longitudes of the main campus of each of Michigan’s postsecondary institutions, from the NCES’ Integrated Postsecondary Education Data System (IPEDS) and the Delta Cost Project Database. These datasets allow me to calculate

17 Throughout this analysis, I do not consider branch or satellite campus locations of community college as, in Michigan, many of these campuses do not offer enough courses to allow a student to complete a degree or earn enough credits to transfer to a four-year university. Thus, I argue that many students will consider the travel distance and travel time to the main campus when deciding whether and where to enroll in postsecondary education.
the straight distance, travel distance, and expected travel time from each high school to each postsecondary institution in the state.\textsuperscript{18} Lastly, I gather annual in-district and out-of-district tuition rates at each of Michigan’s community colleges from Michigan’s Workforce Development Agency.

5.1 Variables

The CEPI dataset provides rich information on the academic performance, demographic characteristics, and postsecondary outcomes of Michigan’s public high school graduates. For academic indicators, the data include a cohort’s graduation rate, calculated as the percentage of students who receive a high school diploma within four years of entering high school, and their average ACT score.\textsuperscript{19} Demographic variables include a cohort’s size, measured as the number of students in the cohort during the junior year of high school, and school-level information on the race and economic status of the student body. The percentage of minority students is calculated as the number of non-white students in the school in the cohort’s graduation year. The percentage of economically disadvantaged students is measured during the same year as the percentage of students in the school who are eligible for free or reduced-priced meals, are in households that receive assistance from SNAP or TANF, are homeless, are a migrant, or are in foster care.

The data also include postsecondary outcome variables gathered from both a state-run data repository and the National Student Clearinghouse (NSC). In particular, for every postsecondary institution $p$ covered by either the state data source or the NSC, the data include the number of students from cohort $c$ and high school $s$ who enroll in institution $p$ within 6 months, 12 months, 16 months, 24 months, 36 months, and 48 months following high school graduation. This allows me to calculate the percentage of graduates in a cohort who enroll in any college, in a particular type of college, or in an individual institution at

\textsuperscript{18}For the first measure, I use the \texttt{sphdist} Stata command, and for the latter two measures, I use the \texttt{geouroute} Stata package developed by [Weber and Péclat (2017)].

\textsuperscript{19}During the years included in my sample, Michigan required all high juniors to take the ACT exam.
different points of time in their academic careers. Because of its linkage to the NSC, the CEPI data cover a much broader set of postsecondary institutions than most datasets previously used to study the effects of community college costs on enrollment decisions. As of 2016, the NSC tracks student enrollment and completion at 96.7% of accredited postsecondary institutions in the U.S. In Michigan, its data cover 99% of institutions, including 100% of public institutions and 96% of private institutions. The missing institutions in Michigan are for-profit institutions, and historically this has been the data’s biggest limitation. However, this is rapidly improving and currently the NSC covers 71.8% of all for-profit institutions and 77.7% of multi-state for-profit colleges, which tend to have the largest enrollments [National Student Clearinghouse Research Center, 2017a]. Because of this coverage, I am able to examine the effects of subsidizing tuition at a student’s local community college education on enrollment decisions in both public and private two- and four-year institutions.

5.2 Descriptive Statistics & Balance Tests

Table 2 provides summary statistics of the key covariates and outcome variables for the 603 observations in my analysis sample. On average, the cohorts in the sample consist of 177 students and have graduation rates around 91%. The students in these cohorts, of which about 9% are minority and 32% are economically disadvantaged, average just under 20 points, out of a possible 36, on the ACT exam in their junior year of high school, which is in line with the national average score [Jaschik, 2016]. Moreover, about half of the schools in the sample are located in rural areas and, as such, tend to be located 30 to 35 minutes away from the nearest postsecondary institutions.

Based on the conceptual framework, the key postsecondary outcomes of interest are: the percentage of students from a cohort not enrolling in any college, enrolling in their local community college, enrolling in any non-local community college, in any vocational college, or in any four-year college. I only consider college enrollments that occur within the first six

\[20\] However, as previously mentioned, the data include coverage of for-profit institutions Everest Institute, ITT Technical Institute, and The International Academy of Design & Technology.

21
months following a student’s graduation from high school. On average, approximately 38% of high school graduates do not immediately enroll in any formal postsecondary education and 62% choose to enroll in one of the aforementioned college types. Of those who enroll, about 29% enroll in their local community colleges, 11% enroll in non-local community colleges, 6% enroll in vocational colleges, and 54% enroll in four-year colleges. However, like the covariates, there is significant heterogeneity in college enrollment rates across schools and cohorts. Notably for the analysis at hand, which considers the effect of a change in local community college tuition on enrollment outcomes, local community college enrollment rates range from 0% to 56%.

Because my analysis will rely on comparing groups of students who graduate from nearby in-district and out-of-district high schools, it is important to assess whether or not these schools are relatively similar across observed characteristics. If there are significant differences in observable characteristics, the schools may also differ in unobservable characteristics that affect postsecondary outcomes, which will pose a threat to my identification assumptions. In order to test for these observable differences, I run a series of balance tests where I regress each covariate on an in-district dummy variable, a cohort fixed effect, and a grouping fixed effect. Table 3 presents the coefficients from each of these regressions, along with robust standard errors that are clustered at the grouping level. On the whole, the two groups of students are quite similar across observable characteristics. In-district high schools are less likely to be classified as being located in a rural area, but have remarkably similar academic performance and student composition to their out-of-district counterparts. For example, both groups of schools have graduation rates of 91% and average ACT scores of about 19.7. I take this as evidence that the paired out-of-district high schools can serve as valid comparison observations for the in-district high schools.
6 Empirical Specifications

In order to estimate the effect of subsidized local community college tuition on postsecondary outcomes, I use both a reduced form and an instrumental variables approach. Both approaches use the intuition of the research design described in Section 4 and differ only in the estimand of interest. The reduced form approach provides an estimate of the effect of attending a high school within a community college district, whereas the instrumental variables approach estimates the effect of facing a $1,000 reduction in local community college tuition upon graduating from high school on the outcomes of interest.

6.1 Reduced Form Empirical Strategy

With data available at the individual level, the desired estimating equation for the reduced form specification is:

\[ Y_{icsg} = \alpha + \beta District_i + X_i \Gamma + Z_{sc} \Pi + \eta_g + \theta_c + \epsilon_{icsg} \] (3)

where \( Y_{icsg} \) is a binary outcome of interest for student \( i \) in cohort \( c \) at high school \( s \) that is part of grouping \( g \). Based on the conceptual framework, \( Y_{icsg} \) may indicate enrollment in the local community college, a non-local community college, a vocational college, a four-year college, or in no college. \( District_i \) is a dummy variable equal to 1 if student \( i \) resides in a community college district and equal to 0 otherwise, \( X_i \) is a vector of individual level control variables, \( Z_{sc} \) is a vector of school-cohort level control variables, \( \eta_g \) is a community college grouping fixed effect, \( \theta_c \) is a cohort fixed effect, and \( \epsilon_{icsg} \) is an idiosyncratic error term. The parameter of interest is \( \beta \). In order for \( \beta \) to represent the causal effect of in-district status on \( Y \), it must be the case that, within a given cohort and grouping, in-district status is uncorrelated with unobserved factors that affect \( Y \), after conditioning on individual and school-cohort level characteristics.

This individual level estimating equation can be aggregated to the following school-cohort
level equation:

$$\bar{Y}_{csg} = \alpha + \beta \bar{District}_{cs} + \bar{X}_{cs} \Gamma + \bar{Z}_{cs} \Pi + \eta_g + \theta_c + \bar{\epsilon}_{csg} \quad (4)$$

where $\bar{Y}_{csg}$ is the share of students in cohort $c$ at high school $s$ in group $g$ for which $Y_{icsg} = 1$, $\bar{District}_{cs}$ is the share of students in cohort $c$ at high school $s$ who reside within a community college district, $\bar{X}_{cs}$ is the average of individual characteristics for students in cohort $c$ at school $s$, and $\bar{\epsilon}_{csg}$ is the average of the individual idiosyncratic errors. Both $\bar{Y}_{csg}$ and $\bar{X}_{cs}$ are available via the data sources described in Section 5. However, $\bar{District}_{cs}$ is not available and, therefore, this equation cannot be directly estimated. Instead, I assume that $\bar{District}_{cs} = 1$ if high school $s$ is located within a community college district and $\bar{District}_{cs} = 0$ otherwise. That is, I assume that all students attending a high school within a community college district reside within the community college district and that all students attending a high school outside of a community college district do not reside within a community college district. In reality, given school choice policies in Michigan, it is likely that the share of students residing within the community college district is slightly less than 1 for high schools within community college districts and slightly greater than 0 for high schools not within a community college district. This will cause my estimate of $\beta$ to be biased downward slightly, but will not drastically alter the qualitative interpretation of my results: instead of estimating the effect of residing within a community college district, I am estimating the effect of attending a high school within a community college district on the probability of a particular postsecondary choice.

For simplicity, I rewrite equation (4) as:

$$\bar{Y}_{csg} = \alpha + \beta District_s + W_{cs} \Phi + \eta_g + \theta_c + \bar{\epsilon}_{csg} \quad (5)$$

where $District_s = \bar{District}_{cs}$ as defined above, which does not vary by cohort, and $W_{cs} = \{\bar{X}_{cs}, Z_{cs}\}$. The variables included in $W_{cs}$ are designed to control for factors that affect
students’ preferences over postsecondary choices. They include the number of students in the cohort, the graduation rate of the cohort, the cohort’s average ACT score, a dummy variable for whether the school is located in a rural area, the percentages of minority and economically disadvantaged students in the school when the cohort graduates, and the estimated travel time from the school to the main campus of the grouping’s local community college, the closest vocational college, and the closest four-year college. I also include quadratic and cubic measures of these travel times in order to allow for a more flexible relationship between travel time and postsecondary choice.

The key identifying assumption in this estimation procedure is analogous to the one outlined in the individual model. Within a given cohort and grouping of high schools, and after controlling for observable covariates, a high school’s in-district status must be uncorrelated with unobservable determinants of a cohort’s postsecondary decisions. Under this assumption, the OLS estimate of $\beta$ will represent the causal effect of graduating from a high school in a community college district on an outcome of interest, $Y$. Specifically, $\beta$ will represent the percentage point change in enrollment in a given postsecondary option that may be attributed to graduating from an in-district high school. However, in order to correct for heteroskedasticity introduced when using aggregate data, I choose to estimate equation (6) via weighted least squares, using the weighting approach suggested by Solon et al. (2015).

### 6.2 Instrumental Variables Empirical Strategy

Beyond comparing the outcomes of students who graduate from in-district and out-of-district high schools, the ultimate goal of this paper is to understand how local community

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21 I choose to use estimated travel time, rather than travel distance or straight distance, because the true travel cost for a student is likely dependent on both an area’s infrastructure and average traffic. The estimated travel time measure incorporates these factors whereas the distance measures do not.

22 The heteroskedasticity is introduced because $\bar{\epsilon}_{csg} = \frac{1}{N_{cs}} \epsilon_{icsg}$, where $N_{cs}$ is the number of students in cohort $c$ at school $s$, will inherently vary by the size of the cohort. Standard tests indicate that heteroskedasticity is present in the data, but the weighted and unweighted estimation strategies do not yield remarkably similar results.
college tuition affects students’ postsecondary decisions. To estimate this relationship, I invoke an instrumental variables approach similar to Denning (2017), where I use a school’s in-district status to instrument for the tuition rate faced by its graduates. The first stage equation is:

\[ \text{Tuition}_{cs} = \alpha + \beta \text{District}_s + \mathbf{W}_{cs} \Phi + \eta_g + \theta_c + \epsilon_{cs} \]  (6)

where \( \text{Tuition}_{cs} \) is negative one times the tuition rate students in cohort \( c \) at high school \( s \) would face at \( g \)’s local community college, measured in thousands of dollars, and the right hand side variables are the same as those in the reduced form estimating equation\(^{23}\) The key right-hand-side variable is \( \text{District}_s \), as in-district status determines whether a student faces the in-district or out-of-district tuition rate at the local community college. The second stage equation is then:

\[ \bar{Y}_{cs} = \lambda + \delta \hat{\text{Tuition}}_{cs} + \mathbf{W}_{cs} \Psi + \mu_z + \omega_c + \nu_{cs} \]  (7)

where \( \hat{\text{Tuition}}_{cs} \) is estimated from the first stage equation. The parameter of interest is \( \delta \), which represents the effect of a $1,000 decrease in local community college tuition on the outcome of interest, \( Y \). This formulation allows me to compare the results to previous estimates of students’ price sensitivity of community college tuition.

In order for \( \delta \) to represent the causal effect of a $1,000 decrease in community college on an outcome of interest, the classical instrumental variables relevancy and exogeneity assumptions must be satisfied. The relevancy assumption imposes that in-district status is correlated with the tuition rates faced by students, i.e. \( \text{Cov}(\text{District}, \text{Tuition}) \neq 0 \). Given that all community colleges in Michigan set tuition rates based on a student’s place of residence, this is very likely to hold. The exogeneity assumption states that, within a given cohort and community college grouping, and conditional on the school-cohort control vari-

\(^{23}\)Following Denning (2017), tuition is defined as the cost of 24 credits, measured in 2016 dollars.
ables, in-district status is uncorrelated with unobservable factors that affect postsecondary outcomes. That is, $Cov(District, \nu) = 0$. This is the same assumption invoked in the reduced form estimation strategy above. Similar to the reduced form approach, I estimate the model using a weighted IV procedure in order to correct for the heteroskedasticity induced by using aggregate data.

While this estimation strategy is similar to that of Denning (2017) in that it scales the reduced form effects by the change in relevant tuition rates, the assumptions necessary for identification are quite different. Denning relies on variation in tuition rates caused by the expansion of community college districts to new public school districts after residents voted for an increase in property taxes in exchange for subsidized tuition at their local community college. That is, he compares students living in the same school district before and after the residents experience a subsidized tuition rate. The assumption needed for identification in Denning’s institutional setting is that, in the absence of a change in the local community college tuition rate, community college enrollment for graduates of the school district would have continued along its pre-treatment trend. In contrast, I rely on variation in tuition rates faced by students within a cohort who reside on either side of a community college district boundary. My key assumptions are that, after controlling for academic and demographic variables, these students differ only in their in-district status offered, and thus, the tuition rate they are offered at the local community college.

7 Results

I now present the results obtained from both estimation approaches. All measures of enrollment presented in this section are calculated only for a students’ initial enrollment decisions within the first six months following their high school graduation. All specifications

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24I also implicitly assume that students do not systematically move to in-district areas prior to high school graduation in order to take advantage of the discounted rate, and that students who attend out-of-district high schools are unable to receive in-district tuition upon initial enrollment (i.e. they cannot declare in-district residency prior to matriculating).
use the full analysis sample and all reported standard errors are clustered at the grouping level in order to account for the possibility of correlated error terms within groupings.

7.1 Reduced Form Results

Table 4 presents the reduced form results. Each column displays the estimated coefficients from a single regression in order to decompose the policy effect into its individual substitution effects. Column (1) considers the effect of in-district status on enrollment in the local community college, whereas columns (2)-(6) consider the effect of in-district status on alternative postsecondary enrollment decisions. As motivated by the conceptual framework, these alternative decisions are: no college, non-local community colleges, vocational colleges, and four-year colleges. I further decompose four-year college enrollment into two categories: enrollment in Michigan’s public universities, which are the most popular four-year enrollment destinations for Michigan’s high school graduates, and enrollment in other in-state and out-of-state four-year colleges. The coefficients presented in the “In-District” row correspond to $\beta$ in equation (5) and represent the change in enrollment probability attributed to graduating from an in-district high school. Based on equation (2), I expect that $\beta$ will be positive for local community college enrollment and negative for the alternative postsecondary options. Further, the coefficients in columns (2)-(6) will sum to the same magnitude as the coefficient in column (1), as any increase in local community college enrollment will be exactly offset by decreases in the alternative options.

In addition to presenting the estimates of $\beta$, I also present the marginal effects of the travel time variables, evaluated at their respective mean values. Because my identification strategy assumes that, after controlling for observable characteristics, students within a grouping only differ in which side of a community college district boundary they reside, and because in-district students mechanically experience shorter travel times to the nearest community college, the difference in travel time between in-district and out-of-district students can be interpreted similarly to the difference in tuition rates between these two groups. That is,
the marginal effect of the travel time to local community college variable should represent
the causal effect of travel time on enrollment probabilities. The same cannot be said for
travel to the nearest vocational college and four-year college, as in-district students do not
necessarily face shorter travel times to these institutions than their out-of-district peers.

I estimate that graduating from a high school within a community college district in-
creases the probability that a student will enroll in that district’s local community college by
6.7 percentage points. This effect is highly statistically significant and large in magnitude; it
is approximately a 38% increase off of the mean local community college enrollment rate of
17.8%. The underlying substitution effects provide evidence on the mechanisms contributing
to this large increase. First, approximately 2 percentage points, or 30%, of this increase can
be attributed to enrollment by students who would not have enrolled in any postsecondary
option had they not graduated from an in-district high school. The in-district coefficient
in column (2) indicates that students who graduate from an in-district high school are 2
percentage points less likely to not enroll in any college than their peers who graduate from
an out-of-district high school. Equivalently, students who graduate from an in-district high
school are 2 percentage points more likely to enroll in any college. This is the participation
effect and indicates that subsidizing community college tuition likely increases educational
attainment for some students.

Second, 3.5 percentage points, or 52%, of this increase is due to students shifting enroll-
ment within the two-year sector. Students who graduate from an in-district high school are
2.5 percentage points less likely to attend a non-local community college and 1.0 percentage
point less likely to attend a vocational college than their students who graduate from an
out-of-district high school. The former result indicates that students who graduate from
in-district high schools are more likely to attend the community college that is nearest to
their geographic area of residence. The latter result, which is highly statistically significant
and represents nearly a one-third decrease off of the mean probability of vocational college
enrollment, indicates that these students are also less likely to attend vocational colleges
than their out-of-district peers. The remaining 18% of the increase in local community college enrollment comes from the between-sector effect, where students forgo attending either Michigan public universities or other four-year colleges in favor of their local community college. However, the coefficients from both regressions are small in magnitude and statistically insignificant, making it difficult to precisely determine whether students forgo attending the state’s public universities, or other four-year colleges, when they have access to a low-cost, local community college option.

The majority of the marginal effects for the travel time variables are small and statistically insignificant. For example, after controlling for in-district status, travel time to the local community college does not appear to affect the probability that a student enrolls in the local community college. This seems to indicate that different tuition rates, rather than different travel times, drive the increased enrollment in the local community college for in-district students. One notable exception to this trend is the "no college" alternative, where travel time to the nearest four-year college appears to be related to a student’s decision to enroll in any form of postsecondary education. At the mean value of 31.24 minutes, a one-minute increase in travel time to the nearest four-year college is associated with an increase the probability of not attending college by 0.3 percentage points, or about 0.8% of the mean. However, this is not necessarily a causal effect and I am unable to determine the exact mechanism by which living closer to a four-year college increases college enrollment. I leave this question to future work.

7.2 IV Results

Table 5 presents the second-stage IV results. The results from the first stage estimation are presented in Appendix Table A.3 and indicate that in-district status is indeed strongly related to the tuition rate a student will face at her local community college, satisfying the relevancy condition. The setup of Table 5 is analogous to Table 4 with the coefficients presented in the “Tuition” row corresponding to $\delta$ in equation (7). This may be interpreted
as the effect of a $1,000 decrease in local community college tuition on the enrollment probabilities of interest. Once again, I also present the marginal effects of the travel time variables evaluated at their mean values. In addition, I calculate estimates of the own-price and cross-price elasticities implied by the enrollment and substitution effects. These estimates are presented in the “Elasticity” row.

The estimated policy effect using the IV procedure is 3.5 percentage points. That is, reducing local community college tuition by $1,000 increases the probability of enrollment in a student’s local community college by 3.5 percentage points, or about 20% of the mean enrollment probability. The decomposition of this increase mirrors that of the reduced form approach. Approximately 30% of the increase may be attributed to an increase in overall postsecondary education participation and an additional 51% is due to within-sector changes in enrollment. Similar to the reduced form results, the decrease in enrollment in the four-year sector is smaller than either the participation or between-sector effects and is statistically insignificant. In addition, the majority of the travel time coefficients are small in magnitude and not statistically significant at conventional levels, with one key exception being the effect of travel time to the nearest four-year college on no college enrollment.

The 3.5 percentage point policy effect is in line with previous work that finds a 2-4 percentage point increase in enrollment per $1,000 decrease in tuition, and is similar to the intent-to-treat results of Denning (2017) and Carruthers and Fox (2016). This enrollment effect, along with the underlying substitution effects, may also be summarized by an elasticity. I estimate an own-price elasticity for local community college enrollment of -0.754, which indicated that a 10% decrease in local community college tuition leads to approximately a 7.5% increase in enrollment.

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25 Elasticities are estimated by using the outlined IV procedure where the tuition variable is now measured as \( \sinh^{-1}(Tuition_{csg}) \), measured in real 2016 dollars, and the dependent variable for each regressions is measured as \( \sinh^{-1}(Enrollment_{csg}) \), where \( \sinh^{-1}(x) = \log(x + (x^2 + 1)^{1/2}) \), and Enrollment\(_{csg}\) is defined as the number of students in cohort \( c \) at high school \( s \) in grouping \( g \) who enroll in the postsecondary outcome of interest. This transformation is used as the inverse hyperbolic sine function, \( \sinh^{-1}(x) \) both allows for zero values and is approximately equal to \( \log(x) + \log(2) \), so that it can be interpreted as a standard logarithmic variable without dropping non-positive observations (Burbidge et al., 1988). Thus, the coefficients presented in Table 5 may be interpreted as the percent change in enrollment attributed to a 1% increase in local community college tuition. Estimates using the standard \( \log(x + 1) \) dependent variable transformation provide qualitatively similar results.
increase in enrollment. This elasticity is partly offset by a cross-price elasticity of non-local community college enrollment of 0.471. Taken together, these elasticities imply an overall community college enrollment elasticity of approximately -0.283. That is, reducing the price of a student’s local community college by 10% would increase overall community college enrollment by about 2.8%. This estimate is remarkably similar to Denning’s estimated price elasticity of community college demand of -0.29 and implies that a program that completely eliminates local community college tuition should increase community college enrollment by about 28%. In addition, I estimate a cross-price elasticity of vocational enrollment is 0.520, which implies that such a program could substantially decrease enrollment in vocational colleges. In contrast, the cross-price elasticities for four-year college enrollment are quite small and indicate that, overall, a policy that reduces or eliminates local community college tuition is unlikely to change enrollment in the four-year sector.

7.3 Implications for Quality

The enrollment substitution patterns presented in Sections 7.1 and 7.2 indicate that over 50% of the increase in local community college enrollment due to the tuition subsidy may be attributed to a decrease in enrollment in non-local community colleges and vocational colleges. Exposure to the subsidy may, therefore, have implications for the quality of education students receive as it shifts their enrollment across colleges with different expenditure levels and quality measures. In this section, I provide suggestive evidence on this effect by calculating a “back-of-the-envelope” estimate of how the quality of education a student receives would change if, because of a subsidy, she is induced to attend her local community college rather than a vocational college or a non-local community college.

Consider a measure of college quality, such as instructional expenditures per student. Let $L_{ics}$ be the quality measure at the local community college for student $i$ in cohort $c$ at school $s$. Let $Q_{ics}$ be the quality measure of the college student $i$ in cohort $c$ at school $s$ would have attended without a subsidy. Then $L_{ics} - Q_{ics}$ is the change in quality of education
received by student \(i\) under a subsidy. I am interested in estimating the average change in college quality that an out-of-district student would likely experience if they were to change their enrollment decision from a non-local community college or vocational college. That is, I wish to estimate
\[
\frac{1}{N} \sum_{i=1}^{N} [L_{ics} - Q_{ics}],
\]
where \(N\) is either the total number of out-of-district students in all cohorts who attend non-local community colleges or the total number who attend vocational colleges. The first part of the estimate of interest, \(\frac{1}{N} \sum_{i=1}^{N} L_{ics}\), can be calculated as \(\sum_{s} \sum_{c} \frac{N_{cs}}{N} L_{cs}\), where \(N_{sc}\) is the number of students in cohort \(c\) at school \(s\) who attend a non-local community college or who attend a vocational college, depending on the outcome of interest. \(L_{cs}\) is the quality measure of the local community college for students at school \(s\) in cohort \(c\), which is constant across individuals within a school and cohort. The second part of the estimate, \(\frac{1}{N} \sum_{i=1}^{N} Q_{ics}\), cannot be directly estimated as the counterfactual enrollment decision is not known for each individual. However, a proxy for \(\frac{1}{N} \sum_{i=1}^{N} Q_{ics}\) can be estimated as \(\sum_{s} \sum_{c} \frac{N_{cs}}{N} \tilde{Q}_{cs}\) where \(\tilde{Q}_{cs}\) is a weighted average of college quality measures over either the non-local community colleges or the vocational colleges attended by students in cohort \(c\) at school \(s\). Therefore, I am able to calculate
\[
\Delta Q = \sum_{s} \sum_{c} \frac{N_{cs}}{N} [L_{cs} - \tilde{Q}_{cs}]
\]
for any college quality measure of interest and any type of college enrollment.

Specifically, I consider three measures of institutional spending related to college quality: instructional expenditures, academic support expenditures, and student services expenditures. Instructional expenditures include all expenses by instructional divisions of an institution (e.g. colleges, schools, departments), and specifically excludes spending on academic administration activities. Academic support expenditures cover all expenses on activities and services intended to support an institution’s missions of instruction, research, and public service. This includes activities such as tutoring, mentoring, and counseling. Student services expenditures are expenses for admissions, registrar activities, and other activities that are designed to contribute to students’ well-being and development outside of formal instruction. Both instructional expenditures and academic support expenditures at

\(\text{All measures are divided by an institution’s number of “full-time equivalent” students (FTEs) in order to account for differences in part-time and full-time enrollment.}\)
public institutions may be responsive to changes in state postsecondary education budgets, and there is increasing evidence that changes in these spending measures can causally affect educational outcomes (Cohodes and Goodman, 2014; Deming and Walters, 2017).

Appendix Table A.4 presents the results from this exercise. The estimates in Column (1) indicate that, on average, a student’s local community college spends $271.59 more on instructional spending per student and $72.31 more on academic support per student than the non-local community colleges attended by members of her cohort. These amount to approximately 6% increases off of the local community college averages for both categories, which are rather small changes and are unlikely to have a meaningful effect on educational outcomes. Moreover, this measure may be skewed by the sample of high schools included in my analysis, which are not necessarily representative of Michigan as a whole. At the state level, the difference in quality between local and non-local community colleges is likely to be close to zero as one student’s local community college will always be another student’s non-local community college. Therefore, I predict that the 37% of the increase in local community college that is driven by decreases in non-local community college enrollment will not have a substantial effect on students’ long-run outcomes.

In contrast, I estimate that students who forgo vocational colleges in favor of their local community college will experience $1062.59 more in instructional spending and $336.07 more in academic support spending. These differences are approximately 25% and 26% increases off of the local community college averages, respectively, and may be able to affect students’ outcomes, although there is currently no research on the causal effects of college quality in the vocational sector. Thus, I predict that the 15% of the increase in local community college enrollment due to decreased enrollment in the vocational sector will likely have a non-negative effect on students’ educational attainment and possibly labor market outcomes. Coupled with the 30% of the increase that may be attributed to new entrants in the postsecondary market, this indicates that approximately 45% of the students whose postsecondary choices are influenced by the subsidy should be affected in a positive manner. An additional 37% of
students who are influenced by the subsidy are unlikely to experience substantial educational quality changes by shifting their enrollment between community college options, and only 18% of affected students are diverted out of the four-year sector. This indicates that locally subsidizing community college tuition may increase educational attainment for a large number of students, and it does not appear that such a policy will drastically discourage four-year college enrollment. Nevertheless, further work should seek to understand the causal effect of such policies on longer-term outcomes, as well as how vocational college quality affects academic persistence, completion, and labor market success.

8 Conclusion

In this paper, I provide new evidence on the effects of reducing community college tuition by using administrative data from the Michigan Department of Education. I exploit an institutional feature of Michigan’s community college system in which students residing within distinct geographic boundaries are offered a substantially subsidized tuition rate at their local community college. I pair high schools within these community college districts with nearby high schools in bordering K-12 public school districts in order to use a variation of a boundary discontinuity research design. Using both reduced form and instrumental variables approaches, I estimate the causal effect of graduating from a high school in a community college district and facing a reduced community college tuition price on students’ postsecondary enrollment decisions, and further provide suggestive evidence on how the induced substitution effects may change the quality of college students attend.

I find that reducing the tuition rate at a student’s local community college by $1,000 increases enrollment by 3.5 percentage points. This estimate is highly statistically significant and is in line with previous studies of college costs. I then decompose this enrollment effect into several underlying mechanisms. I find that approximately 30% of the enrollment increase may be attributed to students enrolling in their local community college who would not have
initially enrolled in any formal postsecondary education in the absence of the subsidy. This amounts to a 1.0 percentage point increase in overall college enrollment per $1,000 decrease in local community college tuition. Similar to some recent work on community college costs (e.g. Denning, 2017), I do not find evidence of a statistically significant between-sector effect by which students forgo attending four-year colleges in favor of their local community college when the price is reduced. Instead, I observe a within-sector effect where students forgo enrolling in non-local community colleges and private vocational colleges when low-cost local community college is available. The latter of these substitution effects may have implications for the quality of education students receive as, on average, a student’s local community college spends substantially more per student on instruction and academic support than vocational colleges.

The results presented here should contribute to the policy discussion surrounding low-cost community college programs and should emphasize the multiple channels through which such programs may influence students’ long-term outcomes. However, one limitation of my results is that I am unable to identify what types of students respond to a decrease in community college price by entering the postsecondary market and what types respond by shifting their enrollment across postsecondary options. If observable characteristics can predict in which way students will respond, targeted policies can be designed to best promote students’ educational attainment. As such, future research should work to explore heterogeneity in the results presented here. In addition, researchers should seek to estimate the causal effect of two-year college quality on educational and labor market outcomes, as well as what non-price factors lead students to attend these institutions.

References


Figure 1: Michigan’s Community College Districts
Figure 2: Average Tuition Rates, 2008-2016
Figure 3: Michigan Public School Districts Mapped to Community College Districts
Figure 4: Lansing Community College Area Boundary School Districts

Figure 5: Lansing Community College Area Groupings (All)

Figure 6: Lansing Community College Area Groupings (In Sample)
Figure 7: School Districts Included in Analysis Sample
Table 1: Mean Tuition Rates at Michigan Community Colleges, 2008-2016

<table>
<thead>
<tr>
<th></th>
<th>Per Credit</th>
<th>Per Semester</th>
<th>Per Year</th>
<th>Annual/Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-District</td>
<td>$94.44</td>
<td>$1133.28</td>
<td>$2266.56</td>
<td>3.78%</td>
</tr>
<tr>
<td>Out-of-District</td>
<td>$155.39</td>
<td>$1864.68</td>
<td>$3729.36</td>
<td>6.22%</td>
</tr>
<tr>
<td>Difference</td>
<td>$60.95</td>
<td>$731.40</td>
<td>$1462.80</td>
<td>2.44%</td>
</tr>
</tbody>
</table>

Table 2: Sample Summary Statistics (N=603)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean  (Std. Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduation Rate</td>
<td>0.910 (0.058)</td>
</tr>
<tr>
<td>Average ACT Score</td>
<td>19.735 (1.352)</td>
</tr>
<tr>
<td>Cohort Size</td>
<td>177.0 (115.0)</td>
</tr>
<tr>
<td>% Minority</td>
<td>0.091 (0.078)</td>
</tr>
<tr>
<td>% Economically Disadvantaged</td>
<td>0.318 (0.141)</td>
</tr>
<tr>
<td>Rural</td>
<td>0.522 (0.500)</td>
</tr>
<tr>
<td>Time to Local Community College</td>
<td>29.05 (8.631)</td>
</tr>
<tr>
<td>Time to Nearest Vocational College</td>
<td>35.22 (15.52)</td>
</tr>
<tr>
<td>Time to Nearest Four-Year College</td>
<td>31.24 (13.90)</td>
</tr>
<tr>
<td>% No College</td>
<td>0.384 (0.119)</td>
</tr>
<tr>
<td>% Local Community College</td>
<td>0.178 (0.108)</td>
</tr>
<tr>
<td>% Non-Local Community College</td>
<td>0.070 (0.081)</td>
</tr>
<tr>
<td>% Vocational College</td>
<td>0.038 (0.033)</td>
</tr>
<tr>
<td>% Four-Year College</td>
<td>0.330 (0.120)</td>
</tr>
</tbody>
</table>

Table 3: Covariate Balance Tests (N=603)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Out (N=279)</th>
<th>In (N=324)</th>
<th>Coeff. (S.E.)</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduation Rate</td>
<td>0.911</td>
<td>0.910</td>
<td>0.000 (0.010)</td>
<td></td>
</tr>
<tr>
<td>Average ACT Score</td>
<td>19.70</td>
<td>19.76</td>
<td>0.051 (0.288)</td>
<td></td>
</tr>
<tr>
<td>Cohort Size</td>
<td>168.4</td>
<td>184.3</td>
<td>2.670 (22.70)</td>
<td></td>
</tr>
<tr>
<td>% Minority</td>
<td>0.083</td>
<td>0.099</td>
<td>0.012 (0.012)</td>
<td></td>
</tr>
<tr>
<td>% Econ. Dis.</td>
<td>0.327</td>
<td>0.310</td>
<td>-0.010 (0.027)</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>0.645</td>
<td>0.417</td>
<td>-0.221 (0.111)</td>
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</table>
Table 4: Reduced Form Enrollment & Substitution Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Local CC Enrollment (1)</th>
<th>No College (2)</th>
<th>Non-Local CCs (3)</th>
<th>Vocational (4)</th>
<th>MI Publics (5)</th>
<th>Other 4-Year (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-District</td>
<td>0.067***</td>
<td>-0.020*</td>
<td>-0.025*</td>
<td>-0.010***</td>
<td>-0.003</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.010)</td>
<td>(0.013)</td>
<td>(0.003)</td>
<td>(0.009)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>ME: Time to CC</td>
<td>0.000</td>
<td>0.000</td>
<td>0.002</td>
<td>-0.001</td>
<td>0.001</td>
<td>-0.002**</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>ME: Time to Voc.</td>
<td>-0.002</td>
<td>0.000</td>
<td>0.003**</td>
<td>-0.001</td>
<td>-0.003*</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>ME: Time to 4-Year</td>
<td>0.000</td>
<td>0.003***</td>
<td>-0.002</td>
<td>0.001*</td>
<td>-0.001</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Mean Enrollment Rate</td>
<td>0.178</td>
<td>0.384</td>
<td>0.070</td>
<td>0.038</td>
<td>0.252</td>
<td>0.078</td>
</tr>
<tr>
<td>N</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.605</td>
<td>0.678</td>
<td>0.744</td>
<td>0.504</td>
<td>0.699</td>
<td>0.672</td>
</tr>
</tbody>
</table>

Notes: Each column displays the results from a single regression. The coefficients shown in the “In-District” row correspond to $\beta$ in equation (5) and represent the percentage point change in enrollment attributable to in-district status. All standard errors are clustered at the grouping level and displayed in parentheses under the coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 
Table 5: IV Enrollment & Substitution Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Local CC Enrollment (1)</th>
<th>No College (2)</th>
<th>Non-Local CCs (3)</th>
<th>Vocational (4)</th>
<th>MI Publics (5)</th>
<th>Other 4-Year (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>0.035***</td>
<td>-0.010*</td>
<td>-0.013*</td>
<td>-0.005***</td>
<td>-0.001</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.001)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>ME: Time to CC</td>
<td>0.000</td>
<td>0.000</td>
<td>0.002</td>
<td>-0.001</td>
<td>0.001</td>
<td>-0.002**</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>ME: Time to Voc.</td>
<td>-0.003*</td>
<td>0.001</td>
<td>0.004**</td>
<td>0.000</td>
<td>-0.003*</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>ME: Time to 4-Year</td>
<td>0.000</td>
<td>0.003***</td>
<td>-0.003</td>
<td>0.001</td>
<td>-0.001</td>
<td>-0.001*</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Mean Enrollment Rate</td>
<td>0.178</td>
<td>0.384</td>
<td>0.070</td>
<td>0.038</td>
<td>0.252</td>
<td>0.078</td>
</tr>
<tr>
<td>Estimated Elasticity $^a$</td>
<td>-0.754</td>
<td>0.039</td>
<td>0.471</td>
<td>0.520</td>
<td>-0.041</td>
<td>0.059</td>
</tr>
<tr>
<td>N</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
<td>603</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.579</td>
<td>0.676</td>
<td>0.729</td>
<td>0.507</td>
<td>0.699</td>
<td>0.673</td>
</tr>
</tbody>
</table>

Notes: Each column displays the results from a single regression. The coefficients shown in the “Tuition” row correspond to $\delta$ in equation (7) and represent the percentage point change in enrollment attributable to a $1,000 decrease in local community college tuition, measured as the listed tuition price for 24 credits. All standard errors are clustered at the grouping level and displayed in parentheses under the coefficients. $^*$ $p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$.

$^a$ The procedure used to estimate own-price and cross-price elasticities are given in footnote 25. The estimates may be interpreted as the percent change in enrollment attributed to a 1% increase in local community college tuition.
A Appendix

A.1 Additional Tables

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baker College</th>
<th>For-Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Associate Degrees</td>
<td>0.614</td>
<td>0.500</td>
</tr>
<tr>
<td>Tuition Rate</td>
<td>$7077</td>
<td>$13,608</td>
</tr>
<tr>
<td>Tuition Reliance</td>
<td>0.987</td>
<td>0.974</td>
</tr>
<tr>
<td>Tuition Discount</td>
<td>0.129</td>
<td>0.042</td>
</tr>
<tr>
<td>% Full-Time Students</td>
<td>0.520</td>
<td>0.382</td>
</tr>
<tr>
<td>Instruction per FTE</td>
<td>$3035</td>
<td>$3740</td>
</tr>
<tr>
<td>Faculty per 100 FTE</td>
<td>9.44</td>
<td>12.55</td>
</tr>
</tbody>
</table>

N 7 10,079

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

Table A.2: Michigan’s Four-Year Institutions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Flagships</th>
<th>Other Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment</td>
<td>45,263</td>
<td>13,633</td>
<td>2,079</td>
</tr>
<tr>
<td>Admissions Rate</td>
<td>0.554</td>
<td>0.748</td>
<td>0.662</td>
</tr>
<tr>
<td>Avg. In-State Tuition</td>
<td>$12,466</td>
<td>$9,104</td>
<td>$22,329</td>
</tr>
<tr>
<td>Instruction per FTE</td>
<td>$15,507</td>
<td>$7,119</td>
<td>$8,714</td>
</tr>
<tr>
<td>Faculty per 100 FTE</td>
<td>20.44</td>
<td>9.98</td>
<td>13.51</td>
</tr>
</tbody>
</table>

N 14 91 182

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

Table A.3: First Stage Results*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
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<tr>
<td>In-District</td>
<td>1.918***</td>
</tr>
<tr>
<td></td>
<td>(0.196)</td>
</tr>
</tbody>
</table>

N 603
F-Statistic 128.64
Adjusted R-Squared 0.928

*Control variable coefficients not shown
Table A.4: Differences in College Quality

<table>
<thead>
<tr>
<th>Spending Category</th>
<th>Local CC Avg.</th>
<th>Δ Non-Local CCs (1)</th>
<th>Δ Vocational (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional per FTE</td>
<td>$4453.81</td>
<td>+$271.59</td>
<td>+$1048.78</td>
</tr>
<tr>
<td>Academic Support per FTE</td>
<td>$1300.88</td>
<td>+$72.31</td>
<td>+$336.07</td>
</tr>
<tr>
<td>Student Services per FTE</td>
<td>$1575.41</td>
<td>+$36.30</td>
<td>-$2.32</td>
</tr>
<tr>
<td>N</td>
<td>217</td>
<td>202</td>
<td>189</td>
</tr>
</tbody>
</table>

A.2 Community College District Boundaries

* Denotes service area locale

<table>
<thead>
<tr>
<th>Community College</th>
<th>Counties</th>
<th>School Districts</th>
<th>Cities/Townships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpena</td>
<td>Alpena</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bay de Noc</td>
<td>Delta</td>
<td>Dickinson*</td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td>Bay</td>
<td>Midland</td>
<td>Saginaw</td>
</tr>
<tr>
<td>Glen Oaks</td>
<td>Branch*</td>
<td>St. Joseph</td>
<td></td>
</tr>
<tr>
<td>Gogebic</td>
<td>Gogebic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td>Counties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Henry Ford</td>
<td>Dearborn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jackson</td>
<td>Jackson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kalamazoo Valley</td>
<td>Climax-Scotts, Comstock, Galesburg-Augusta, Gull Lake, Kalamazoo, Mattawan, Parchment, Portage, Schoolcraft, Vicksburg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kellogg</td>
<td>Albion, Athens, Battle Creek, Harper Creek, Homer, Lakeview, Mar-Lee, Marshall, Pennfield, Tekonsha, Union City</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kirtland</td>
<td>Crawford-AuSable, Fairview Area, Gerrish-Higgins, Houghton Lake, Mio-AuSable, West Branch-Rose City</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Michigan</td>
<td>Berrien</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macomb</td>
<td>Macomb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid Michigan</td>
<td>Beaverton, Clare, Farwell, Gladwin,Harrison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monroe County</td>
<td>Monroe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montcalm</td>
<td>Carson City-Crystal, Central Montcalm, Greenville, Lakeview, Montabella, Tri County, Vestaburg</td>
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</tr>
<tr>
<td>Region</td>
<td>Sub-Region</td>
<td>Counties</td>
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</tr>
<tr>
<td>------------------------</td>
<td>--------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Mott</td>
<td></td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Muskegon</td>
<td>Muskegon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Central Michigan</td>
<td>Emmet</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Grand Traverse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakland</td>
<td>Oakland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoolcraft</td>
<td></td>
<td>Clarenceville, Garden City, Livonia, Northville, Novi (part), Plymouth-Canton</td>
<td></td>
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<tr>
<td>Southwestern Michigan</td>
<td>Cass</td>
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<td></td>
<td>Keeler, Hamilton</td>
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<tr>
<td>St. Clair County</td>
<td>St. Clair</td>
<td>NOT INCLUDED: Anchor Bay, Armada, Richmond, Croswell-Lexington</td>
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<tr>
<td>Washtenaw</td>
<td>Washtenaw</td>
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<tr>
<td>Wayne County</td>
<td>Wayne</td>
<td>NOT INCLUDED: Dearborn, Garden City, Highland Park, Livonia, Northville, Plymouth, Canton (part)</td>
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</tr>
<tr>
<td>West Shore</td>
<td></td>
<td>Bear Lake, Free Soil, Kaleva-Norman-Dickson, Ludington, Manistee, Mason County Central, Mason County Eastern, Onekama, Walkerville</td>
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<tr>
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<td>Crystal, Elbridge, Weare</td>
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