College on the Cheap: Consequences of Community College Tuition Reductions

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This paper examines the effects of community college tuition on college enrollment. I exploit quasi-experimental variation from discounts for community college tuition in Texas that were expanded over time and across geography for identification. Community college enrollment in the first year after high school increased by 5.1 percentage points for each $1,000 decrease in tuition which implies an elasticity of -.29. Lower tuition also increased transfer from community colleges to universities. Marginal community college enrollees induced to attend by reduced tuition have similar graduation rates as average community college enrollees.
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Community colleges are a large part of the United States higher education system. In 2011, community college students represented 45 percent of all students enrolled in higher education and 42 percent of first time freshmen.[1] Community colleges have recently received increased policy attention due to President Obama's"America's College Promise" proposal to make community college free to students as well as similar initiatives that have recently been enacted in Tennessee and Oregon. Despite the importance of community colleges, most research on investments in higher education has focused on four-year schools.[2] Estimates from this literature may not carry over to community colleges as they differ from four-year universities in many ways. Unlike many universities, community colleges are open-enrollment which means they are open to any student who has a high school diploma or GED credential.[3] Community colleges students are more likely than four-year university students to be from backgrounds with historically lower educational attainment such as racial minorities and low-income families and are also more likely to be the first generation of college students in their family (Nunez and

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[1] I will refer to two-year schools as community colleges throughout this paper, though in principle two-year colleges can include technical schools as well as community colleges. These statistics are calculated by the American Association of Community Colleges using the 2012 NPSAS.

[2] Kane and Rouse (1999) provide a summary of community colleges, their history and impacts.

[3] Community colleges often offer remedial courses that enable students without a high school diploma or GED to eventually enroll in community college

Carrol, 1998; Bailey, Jenkins and Leinbach, 2005). Community colleges also stand in contrast to many other college options in that they are substantially less costly to attend. In 2010-2011, average annual community college tuition was $2,439 while average tuition at public four-year institutions was $7,136, with private four-year institutions being even more costly at $22,771. After adjusting for inflation, public four-year college tuition has risen 241 percent since 1981 while community college tuition has risen at a slower pace of 159 percent. (National Center for Education Statistics, 2014) Community colleges may become more attractive as four-year college costs continue to rise faster than community college costs. In fact, the net price of community college (accounting for financial aid) actually decreased from 2000 to 2009 while four-year net college price increased over the same period (Gillen, Robe and Garrett, 2011).

Estimating the effect of community college price on enrollment has been difficult for at least two reasons. The first is identification: even in settings where the relevant community college tuition is known for each student, community college tuition may be set in ways that reflect unobserved characteristics about the community college's base of potential students. I overcome the challenge in identification by leveraging changes in students' eligibility for community college tuition discounts across time and geography. The second difficulty associated with estimation is the data requirements–one needs data that links the potential pool of enrollees and tuition. I am able to use administrative records on all public high school graduates in Texas and their college enrollment.

I leverage the expansion of discounts for tuition in Texas in a differences in differences framework to identify exogenous price changes. Community colleges in Texas are partially supported by locally property taxes. Students who live in municipalities that pay to support a community college receive a discount on tuition called "in-district tuition" where students who do not live in those municipalities do not and pay "out-of-district tuition." I exploit the annexation of several municipalities into community college taxing districts to provide exogenous variation in community college tuition. Using this identification, I find that a $1,000 decrease in community college tuition increases immediate enrollment in community colleges by 5.1 percentage points (pp) relative to a baseline of 26.5 pp. In addition, my estimates suggest that students induced to attend a community college have similar graduation patterns as average community college students.

Relative to previous work on community colleges this paper contributes to the literature by providing an estimate of the effect of community college price using plausibly exogenous changes in community college tuition. Previous work has generally used cross state variation in community college prices. (Kane, 1995; Rouse, 1994). A notable exception is work concurrent to this paper, Martorell, McCall and McFarlin (2014) which examines the effect of community college prices on college enrollment in Texas by leveraging variation in community college tuition induced by taxing districts. They conclude that living in community college taxing districts increases college attendance. While they use similar institutional features for identification, the identifying assumptions are quite different than those used in this paper. They compare students who live on opposite sides of district boundaries who face different community college costs and argue that the students are otherwise equivalent. Martorell, McCall and McFarlin (2014)

builds on McFarlin (2007) which uses a similar strategy and administrative data in Texas. A key concern is whether students who live on opposite sides of the boundaries sort based on educational amenities. Kane, Riegg and Staiger (2006) explores student sorting and finds that sorting across school district boundaries does occur. My paper uses variation induced by changes in these boundaries over time, thereby comparing individuals who live in the same K-12 school districts.

The paper unfolds as follows. Section I discusses the conceptual framework for enrollment responses to community college costs and the long term effects of community college enrollment. Section II describes the institutional setting explored in this paper. Section III describes the data. Section IV discusses the identification strategy and results for the effect of community college price on enrollment. Section V discusses the identification strategy used to examine the longer run effects of community college as well as the estimated effects of community college on longer run outcomes. Section VI discusses how the effects estimated differ by race, gender, and income. Section VII presents a back of the envelope calculation for free college proposals. Finally, Section VIII concludes

I. Conceptual Framework

Economic theory predicts that lowering the costs of college will increase college enrollment. This common sense prediction is verified in prior work that generally finds a $1,000 decrease in college costs leads to a 2-4 pp increase in enrollment. (Dynarski, 2000, 2003, 2004; Scott-Clayton, 2011; Castleman and Long, n.d.; Seftor and Turner, 2002; Turner, 2011; Carruthers and Fox, 2016).[4] However, these studies do not generally distinguish between two-year and four-year college costs because they study grants that apply to both community colleges and universities. This paper expands the work on price sensitivity of college enrollment by specifically examining the effects of community college price on community college and university enrollment.[5]

Prior literature has typically examined the effect of additional grant aid which changes the net price of college. However, this study focuses on reduction in the sticker price of college. Changes in the sticker price of college differ in several ways from changes in financial aid. First, changes in sticker price reduce the cost of college for a broader group of students which includes students who do not receive any financial aid or who do not fulfill requirements for financial aid. Relatedly, since the tuition change applies to all students it can affect students who would have been affected by a targeted grant program but who do not meet often-complicated requirement (Bettinger et al., 2012). Reducing the sticker price of college also subsidizes college for inframarginal students who would have attended at higher prices.

[4] Deming and Dynarski (2010) summarize this literature.

[5] Carruthers and Fox (2016) examines the implementation of the Knox Achieves program that provided a last-dollar scholarship for community college tuition and fees as well as college coaching for students in Knox County, Tennessee. In this combined program, they found reducing community college tuition and providing college coaching substantially increased enrollment at community colleges. They find a smaller degree of switching from universities to community colleges but their estimates vary depending on specification with some essentially being zero. They also find students who switched enrollment from universities to community colleges were from higher income backgrounds. Ultimately they are unable to separate out the effects of coaching and financial aid but find evidence that both are important.

One might expect larger effects for changes in community college tuition than for increases in financial aid primarily used at universities for several reasons.[6] On average, community colleges serve a lower-income population that may be more price sensitive. Also, a $1,000 reduction in tuition represents a substantially higher fraction of total costs at community colleges than at universities so students may have a stronger response to the same dollar amount reduction in community college costs as compared to universities. Lastly, studies using cross-state variation have found larger effects for community college price sensitivity than for universities (Kane, 1995; Rouse, 1994).[7] However, these studies should be interpreted with caution as they may capture other factors like changing policy objectives of states rather than changes in community college enrollment caused by changes in community college costs. This work expands the large literature on the price sensitivity of college enrollment by providing evidence on the effect of community college prices on enrollment.

Moreover, the setting described in this paper allows me to identify both the own price enrollment elasticity of community college and the cross price elasticity for four-year enrollment due to better measurement of community college tuition. Prior studies have largely focused on the effect of a $1,000 change in the price of college usually caused by changes in financial aid. However, the interpretation of this parameter across time and different college settings is difficult as the value of $1,000 changes and represents a different fraction of total price. Estimating an elasticity allows a comparison across time and different settings because it is unitless.

There is also a related literature that examines the changes in enrollment patterns that occur when the costs of one sector of post secondary education are decreased and the costs of other sectors are held constant. Prior work has focused on subsidies for in-state colleges, and the present study expands that literature by focusing on a different sector–community college. Cornwell, Mustard and Sridhar (2006); Goodman (2008); Cohodes and Goodman (2014) find that students were less likely to attend out of state colleges when scholarships that reduced the cost of attending in state were implemented. Cohodes and Goodman (2014) also document that the change in student enrollment patterns reduced graduation rates. Similarly, I examine the effects of a change in the relative price of community college on educational outcomes like graduation and credits attempted similar to Cohodes and Goodman (2014).

It is not clear ex ante which students will respond to decreases in the price of community college. Students who enroll in community college due to decreased costs could come from two groups: students who were planning on attending four-year universities or students who were not going to enroll in college. Knowing who responds to community college price changes is important for policymakers considering the effects of community college tuition. Most existing work has not explicitly considered who is at-

[6] Other costs of college have been shown to be relevant for community college enrollment including distance (Jepsen and Montgomery, 2009; Miller, 2007) and weak labor markets (Betts and McFarland, 1995).

[7] However, Hilmer (1997) finds that the price elasticity for community colleges is lower than it is for universities. Nutting (2008) also examines the enrollment elasticity of community college enrollment using cross-campus, cross-year variation in community colleges in New York and finds that there is a negative relationship between community college enrollment and price. However, the estimates are not easily interpretable as rates of community college attendance.

tracted to community colleges when community college price changes, and this study will be able to answer this question.

Increased access to community colleges has a theoretically ambiguous effect on ultimate educational attainment.[8] As articulated by Rouse (1995), there are two competing forces that affect educational attainment when there is increased access to community college: democratization and diversion. Democratization occurs when students switch from no college enrollment to enrollment in community college which would have positive effect on overall educational attainment. However, the diversion effect occurs when increasing access to community college diverts students from four-year universities to two-year colleges. Diversion could reduce overall educational attainment if students who switch do not go on to get a bachelor's degree. This paper will provide quasi-experimental evidence of which effect dominates.

II. Texas Community College System

Community colleges typically provide both academic and vocational training whereas universities focus on academic subjects. Academic training at community colleges is designed to award associates degrees and help students transition to a four-year university. Technical training typically takes the form of a certificate program and offers vocational skills.

Texas provides an ideal laboratory to study community college enrollment; there are 50 public community colleges, each serving distinct geographical areas.[9] Specific municipalities pay ad-valorem property taxes to support each community college.[10] Students who live in tax-paying municipalities receive a substantial discount on tuition called "in-district" tuition. The boundaries of community college taxing districts where students are eligible for in-district tuition is shown in Figure 1. For the 2014-2015 school year, community colleges in Texas charged 63 percent more, on average, to out-of-district students relative to in-district students. This paper leverages over 20 expansions in taxing boundaries that have occurred since 1995 that induced large changes in tuition. The timing of these expansions is outlined in Table 1.

Figure 1 about here
Table 1 about here

Importantly for my identification strategy, at least five community colleges in Texas have expanded their taxing district through annexation of municipalities. The first annexation contained in the data occurred in 1995 and, in total, I was able to identify 22

[8] In this paper, increased access to community college will be caused by decreased community college tuition.

[9] In addition to the 50 public community colleges the Texas State Technical College System and Lamar State University system also provide public, two-year college options.

[10] This in-district feature of community college tuition pricing is present in a few other states namely Arizona, Arkansas, Illinois, Maryland, Michigan, Missouri, Montana, New Jersey, New Mexico, Pennsylvania, and South Carolina. These states do not necessarily have this feature at all community colleges in the state but do at at least some community colleges. In the 2012-2013 school year nearly 70 percent of community college students in Texas were paying in-district tuition. An exception is El Paso Community which does not offer a discount to students who live in the taxing district.

municipalities that joined a community college district. These expansions have increased the number of students eligible for reduced, "in-district" tuition.[11] The colleges that have expanded and are the focus of my study are Austin Community College, Lone Star College, Amarillo College, Houston Community College, and Hill College.[12] Table 1 lists the expansions and Figure 2 shows the districts annexed. These colleges represent a range of sizes and geographies with Hill College being in a rural setting and having just over 4,000 students enrolled in Fall 2013 and Lone Star College in Houston having over 61,000 students enrolled in the same year. It is the variation in community college price induced by annexations of municipalities that I will use for my identification.

Figure 2 about here

In order for a tax entity to be added to the taxing district for a community college, the residents must gather signatures for a petition to vote on annexation into the community college taxing district. After a petition has a sufficient number of signatures, a vote authorizing an increase in property taxes is taken. The increase in property taxes is on the order of $.10 per $100 of property value, although it varies by college. Community colleges use the property tax revenue from their taxing district as well as other sources of revenue including state appropriations, and tuition and fees to fund their operations. As soon as a municipality approves the property tax, students begin paying in-district tuition as opposed to out-of-district tuition. The assumptions required to use these annexations as variation in community college tuition will be discussed further in Section IV.

The process by which annexation votes occur is different for different municipalities. Sometimes a group of citizens initiates the vote, sometimes the community college seems to initiate the discussion. Ideally, there would be many close votes and a regression discontinuity design could be employed to find the effect of a successful annexation. Unfortunately there are only 22 annexations in the data set collected for the this paper and none of them for which I was able to find the voting were closer than 59 to 41 in favor of annexation.[13] I have also identified a few instances where a vote for annexation failed and will use these as a test of identification.[14]

Many times the vote for annexation also includes plans for new facilities being built in the annexed area. Table 1 contains a list of relevant campus building projects and building open dates. Additional campuses reduce the costs of attending community college and may influence both non-monetary costs like convenience and monetary costs.[15] I will control for the presence of new campuses to isolate the change in tuition associated with

[11]There has been one additional annexation at Brazosport College after the time covered by the data. Also there was an additional annexation for Austin Community College of the City of Austin in 2005, but this annexation does not map into a school district as it annexed only parts of school districts and is excluded for this reason.

[12]Lone Star College was known as North Harris Montgomery Community College District prior to 2007.

[13]I describe how annexation data, including vote totals are collected in Appendix A

[14]Annexation into taxing districts during this time frame only happened in taxing districts that were defined municipalities smaller than the county level. The general pattern has been the taxing district expands from the city center out to contiguous school districts.

[15]New campuses are often located relatively close to existing campuses and as such are unlikely to affect the decision to live at home if attending community college.

annexation. I also estimate the effect only for the annexations that did not include new campuses.

III. Data

The data for this project come from several sources. The primary student-level data come from the Texas Education Research Center (ERC) and cover the school years that start from 1994-2012 although the primary estimating sample will focus on 1994-2005.[16] These data contain demographic and academic performance information for all students in public K-12 schools in Texas provided by the Texas Education Agency. These records are linked to individual level enrollment, graduation, and financial aid data from all public institutions of higher education in the state of Texas using data provided by the Texas Higher Education Coordinating Board. Data on tuition comes from the Texas Association of Community Colleges and contains tuition information starting in 1992. Data on tuition is on the sticker price of attendance rather than on tuition actually paid by students. However, sticker price is particularly relevant in the community college setting and is very close to what is actually paid by students. Sticker versus actual price will be discussed further in Section IV. County level unemployment rates for August of each year from the Bureau of Labor Statistics are also used.

I assembled information on community college districts in Texas by visiting each community college's website and through conversations with administrators in cases of ambiguity.[17] Historical information for each school district's annexation history was obtained several ways. For a detailed description of determining annexation dates see Appendix A.

A. Measuring Tuition Status

Eligibility for in-district tuition depends on the taxing district of a student's residence. The ERC data do not contain precise address information or taxing district information, so in-district status for the purposes of this paper is inferred by the in-district status of a student's high school. In all instances in this study, the boundaries for community college taxing districts are defined by school districts which means eligibility is observed with smaller error than when using other geographic boundaries. However, there are several reasons for measurement error in taxing district residence including attending a high school for which the student does not live in the boundary and students who move the year after high school.

For students who attend community college, the data contain whether they paid in-district or out-of-district tuition. Panel A of Figure 3 shows that the fraction of students paying in-district tuition increases sharply in the year of annexation. This figure is created using students who graduated from K-12 school districts that would experience annexation and plots the fraction who paid in-district tuition while attending community

[16] For a description of these data see http://www.utaustinerc.org/

[17] The information compiled from school websites for the district of each school is available upon request.

college. This figure should be interpreted with caution as annexation will be shown to cause students to enroll in community college, but it is useful for illustrating the discrete change in payment of in-district tuition. Ideally, the data would reveal the change in the fraction of students *eligible* for in-district tuition. However, only the change in students actually *paying* in-district tuition can be measured. In the period after annexation, some students will have their in-district status changed and other students will not. This can be seen in Panel A of Figure 3. The new attendees are likely to be students who did experience a change in tuition status because those students face lower tuition costs. For this reason, the plotted or estimated change in in-district tuition payment is likely to increase more than the change in the eligibility for in-district tuition.

Prior to annexation around 15 percent of students are paying in-district tuition; after annexation the number is approximately 80 percent. In the first year of annexation there appears to be some slippage, with approximately 60 percent of annexed students paying in-district tuition. This could be explained by administrative or data issues in the implementation of annexation. In the data for individual K-12 districts, the first year of annexation often has a smaller fraction paying in-district tuition than subsequent years which suggests that the slippage is not due to measurement error in the annexation date. Figure 3 Panel B demonstrates that the annexations did affect the price paid by students for community college.[18]

Figure 3 about here

When interpreting the effects of a $1,000 change in tuition it is important to remember that tuition is assigned to change for all students who attended a K-12 district that was annexed. However, Table 4 show that among students who enrolled in community college, 55 percent of students changed from out-of-district to in-district. As previously discussed, the 55 percent estimate is likely to be an overestimate because students who are eligible for in-district tuition are more likely to attend community college and thus appear in the data than students who are not eligible for in-district tuition. To further reduce the measurement error in tuition, estimates that measure the effect of a $1,000 tuition change should be scaled up by dividing by .55 (or multiplying by 1.8). Because .55 is likely to be an overestimate of the true change in in-district eligibility, dividing by .55 will not scale up the results as much as if the coefficients were divided by the true, smaller estimate. As such, dividing by .55 is likely to be a lower bound on the effect of a $1,000 change in tuition. For this reason, results that are scaled by tuition will also be scaled by the change in in-district eligibility.

Another important consideration for interpretation is how annexation affects the net price of college. To this point, I have focused on changes in tuition but annexation could also affect grants and influence net price through changes in grant aid.[19] If decreases in

[18] For comparability, only schools that had five years prior to annexation and five years after were included in Panel B of Figure 3.

[19] Grants will be defined as the annual amount of Federal Pell Grants, Federal Supplemental Educational Opportunity Grants, TEXAS Grants, and Texas Public Education Grants. All of these grants are need-based but are funded by different sources. TEXAS Grants are funded by the state and Texas Public Education Grants are funded by individual colleges.

tuition are offset by decreases in grant payments, then the magnitude of the change in tuition will overstate the actual change in the costs of college.

I investigate this by examining the patterns of grants received. Only students who enroll in community college are observed, and prior results show that annexation is related to additional students enrolling in community college. Because annexation affects enrollment, and thus the sample used in estimation, the result on grants should be viewed as descriptive rather than causal. Data on grants disbursed starts in 2001 and so results presented will be from 2001 to 2012. Column 3 of Table 4 examines the effect of annexation on grant aid received at community colleges and finds a statistically imprecise decrease in grant aid received of $173. When considering only students who received some grants at a community college in Column 4 of Table 4, the average amount of grants received went down after annexation by $286. Even after accounting for imperfect measurement of eligibility this represents roughly half of the change in tuition. However, the number of students receiving grants at community colleges during this time period is relatively small with 15-20 percent receiving nonzero grants.[20] This suggests that there may be small countervailing effect of reduced grants, but this only affects a minority of high school graduates. The evidence on changes in grants suggests that the results may be biased downwards.

B. Constructing the Sample

The sample used for analysis consists of students who graduated from Texas public high schools when 17 or 18 years old between 1994 and 2005. I will first examine the immediate transition of these students to college. Studying on-time graduates of high school and their enrollment behavior in the fall after their graduation has the advantage that on-time high school graduates were unable to manipulate the timing of their entry into college as a result of changing tax jurisdictions. This is because the annexation vote takes place during their senior year. Students who were out of high school for some time may wait to enroll in college until after a vote is taken. However, examining recent high school graduates will only capture part of the total effect of annexation and lower tuition on community college enrollment. For instance, lower tuition is also likely to attract other students to "go back" to school.

Because the sample is selected from high school graduates the estimates may be biased if annexation changes the probability of graduation from high school. This might happen if students see the opportunity for less costly post secondary schooling and change their effort. This is tested in the last column of the second row of Table 5 which shows that students do not change high school graduation behavior in response to less expensive community college tuition.[21]

For the majority of the analysis, the sample is limited to students who graduated from high school from 1994-2005. This allows an examination of graduation outcomes like

[20] This is likely due to issues explored in the literature on FAFSA take up and financial aid complexity Bettinger et al. (2012); Dynarski and Wiederspan (2012).

[21] This test is discussed in more detail in Section IV.

bachelor's degree receipt eight years after high school. I also use students from 1994-2012 for enrollment outcomes to take advantage of additional annexations that occur from 2006-2012, and these results are discussed in Appendix B. The sample is limited to students from K-12 school districts that are part of a community college taxing district that experienced annexation from 1994 to 2005. As a result, all K-12 districts in the sample will be part of a community college taxing district by 2005. This restriction causes the sample to consist of approximately 15 percent of high school graduates in Texas during this time period.[22]

Table 2 contains summary statistics for the primary estimating sample which includes high school graduates from 1995 to 2006. K-12 districts that experienced annexation makes up 39 percent of the observations and post-annexation observations account for 25 percent of the observations. 27 percent of students attend community college immediately after high school graduation, and 25 percent attend public universities. Table 3 splits the data for the districts that experienced annexation before and after the annexation. After annexation there are increases in community college enrollment, in-district community college enrollment, payment of in-district tuition, graduation probability, and credit hours at community colleges and universities. Tuition drops from $1962 annually to $1160. These preview the results, but the patterns described here generally hold upon more precise statistical examination.

Tables 2 and 3 about here

IV. Community College Price Sensitivity

A. *Identification*

The primary goal of this paper is to uncover the effect of community college tuition on enrollment patterns. This is difficult for a number of reasons as previously discussed including identifying the relevant community college tuition and finding variation in community college price unrelated to student characteristics. To address these issues, I exploit previously described institutional features of the Texas community college system. For the assignment of community college tuition I leverage the fact that Texas students face differential tuition depending on their residence. The system of in-district tuition creates a rule that assigns the relevant community college tuition. Namely, prior to a K-12 district's annexation the price of community college is the out-of-district price and after annexation, it is the in-district price. I also overcome the challenge of tuition being set in response to student characteristics by exploiting sharp changes in tuition within K-12 school districts over time by using taxing district annexation (which represents a substantial shock to the cost of community college for students).

To identify the causal impacts of tuition on enrollment, I implement a differences in differences estimator by comparing enrollment of annexed districts to districts already

[22]For analysis that includes years up to 2012 the sample is expanded to include a new community college taxing district that experienced annexation, Houston Community College.

in a taxing district before and after annexation takes place. The language of a quasi-experiment will be employed with annexed K-12 districts being referred to as the treatment group and districts already included in the community college taxing districts being referred to as the control group.[23] Because the variation in tuition occurs at the K-12 district/year level I cluster standard errors at the K-12 district level.[24] To examine the effect of annexation or treatment the following reduced form equation is estimated:

$$Y_{icdt} = \theta \cdot Annexation_{dt} + X_{idt}\alpha + W_{tc}\beta + \gamma_d + \eta_t + \tau_{tc} + \epsilon_{icdt} \quad (1)$$

Importantly, i indexes individuals, d indexes K-12 districts, t indexes school year, c indexes community college district, and ϵ_{icdt} represents an idiosyncratic error term. Y_{icdt} is a student enrollment outcome like attendance at community college and $Annexation_{dt}$ is an indicator for a K-12 district d that has been annexed in year t. As such, θ is parameter of interest and is the effect of annexation and the attendant reduced tuition on a student outcome. Variables that control for K-12 district characteristics that may be related to college-going are included in X_{idt} like race, gender, an indicator for economic disadvantage, and limited English proficiency.[25] X_{idt} also includes an indicator for a new campus of the community college being open in the K-12 district. W_{ct} contains covariates that control for factors affecting college attendance at the community college district level like county unemployment rates and number of high school seniors in the graduating cohort; these are only included in specifications without college/year fixed effects.[26]

In addition to district characteristics, fixed effects for K-12 district, γ_d, and year, η_t, are included. These fixed effects control for fixed observed and unobserved characteristics of K-12 districts including proximity to college. They also control for fixed community college characteristics as K-12 districts comprise the community college taxing district. Year fixed effects account for trends in community college enrollment and for factors common to all community college districts that change with time. In addition to year fixed effects, in some specifications time is also accounted for using community college-specific linear time trends. However, in the preferred specification, community college district-by-time fixed effects, τ_{tc}, are included to account for common trends and shocks that occur to both the treatment and control group in a community college district.

The rich set of controls and fixed effects in Equation 1 enable a comparison of enrollment rates *within* K-12 districts *across* cohorts who experienced lower tuition. The K-12 districts who were already part of the taxing district serve as the comparison group.

[23]The control K-12 districts are already included in the taxing district of the college. These districts are likely to be most similar to annexed districts because they are in the same locality and they have access to community college services. Choosing K-12 districts that were never treated would be problematic because the students are further away from the community college and are less likely to attend the community college under consideration. The control districts were all annexed prior to 1992 or were included initially in the formation of the taxing district.

[24]Performing the analysis on data collapsed into K-12 school district/year cells that are weighted by the number of high school graduates in the cell yields very similar results.

[25]Economic disadvantage is determined by free and reduced lunch receipt.

[26]Bound and Turner (2007) find that large cohort sizes within states lead to low educational attainment, so I control for cohort size explicitly.

These controls are in place so that θ captures only the effect of taxing district annexation after controlling for K-12 district fixed characteristics, demographic characteristics, time effects, labor market conditions, trends common to all K-12 districts in the community college district, and new campuses.[27]

Equation 1 captures the effect of annexation and the resulting cheaper tuition on student outcomes. However, this does not scale the effects of annexation by the change in tuition. In order to do this an instrumental variables strategy is used where listed community college tuition is instrumented for using $Annexation_{dt}$ as in the following first stage equation:

$$Tuition_{cdt} = \varsigma \cdot Annexation_{dt} + X_{dt}\phi + W_{ct}\chi + \vartheta_d + \delta_t + \omega_{ct} + \mu_{cdt} \tag{2}$$

The second stage equation becomes:

$$Y_{cdt} = b \cdot \widehat{Tuition}_{dt} + X_{dt}\kappa + W_{ct}\rho + \pi_d + \zeta_t + \lambda_{ct} + \upsilon_{cdt} \tag{3}$$

$Tuition_{dt}$ is the sticker price of community college tuition and fees for two semesters of 12 credit hours measured in 1,000s of 2012 dollars. Prior to a K-12 district's annexation $Tuition_{dt}$ is the out-of-district price and after annexation, it is the in-district price. The parameter of interest is b which is the coefficient on in-district tuition and represents the effect of a \$1,000 increase in sticker tuition on enrollment outcomes. Several outcomes will be considered as Y_i including indicators for community college enrollment, enrollment in the in-district community college, four-year university enrollment, and no enrollment. This will allow an investigation of not only the own price sensitivity of community college enrollment, but also the cross price sensitivity for four-year college enrollment.

Assumptions for Identification

For the identification strategy used to examine the effect of annexation on enrollment to be valid, I must assume that treatment and control K-12 districts have the same trends in college enrollment prior to treatment.[28] While this seems reasonable given that students in these K-12 districts share many common characteristics like geography, labor markets, etc., the difference in community college enrollment for annexed and already included

[27] As an illustrative example of the spirit of the estimator, consider the annexation of Del Valle Independent School District (ISD). Dell Valle ISD was annexed into the Austin Community College taxing district in 2004 and will serve as the "treatment group". After 2004, high school graduates from Del Valle ISD experienced reduced tuition as a result of annexation into the taxing district. Austin ISD was part of the Austin Community College taxing district many years prior to the data and will serve as the "control group" because students in Austin ISD did not experience substantial changes in tuition. I compare the change in enrollment rates for Del Valle ISD before and after 2004 to changes in enrollment rates for Austin ISD before and after 2004. The difference in these differences is interpreted as the effect of the reduced tuition resulting from annexation on community college enrollment. The actual estimation performs this type of exercise for many treatment and control districts simultaneously while also controlling for many other factors.

[28] Formally the assumption for identification is that $E(\epsilon_{icdt}|Annexation_{dt}, X_{idt}, W_{tc}, \gamma_d, \eta_t, \tau_{tc}) = 0$.

districts can be seen in Figure 4 where in the years prior to annexation there appears to be no difference in trend.[29] In addition to this visual test presented later in the paper, I test for parallel trends explicitly in each case of annexation.[30]. Two annexed districts had trends that were different than the already included municipalities in the taxing district at the 5 percent level–Dumas and Hereford. The exclusion of these annexations does not change the results substantially.[31]

Another assumption is that there are no other shocks occurring at the same time as annexation that would also affect the decision to enroll. To address this issue I control for potential confounders like demographic characteristics, indicators for new community college campuses in the K-12 district, and use year-by-college fixed effects to capture shocks common to treatment and control groups. While there could still be unaccounted for shocks that occur, the shocks would have to be systematically correlated to annexation across different colleges and districts. It is worth noting that a shock to the entire community college taxing district would be experienced by both the treatment and control groups and would not be an issue except if treatment and control districts reacted to the shock differently.[32] A particular concern is that funding for community colleges will increase after annexation votes which may have an effect on enrollment. However, the funding will increase for both the annexed and already-included districts. Hence any increase in enrollment strictly due to increased funding for the community college will be experienced by both treatment and control K-12 districts.

As previously discussed, annexation is always associated with a vote approving the annexation. The assumption is that timing of a vote authorizing annexation is exogenous or unrelated to factors that may affect community college enrollment. The timing of votes cannot be related to the underlying characteristics of students or taxing district.

One way to test that annexation is unrelated to other factors is to examine whether observable characteristics of a district are related to annexation. If student observable characteristics are related to annexation, student unobservable characteristics are likely to be related as well. Table 5 presents these results and finds that annexation is unrelated to gender, race, economic disadvantage status, and limited English proficiency indicators. I combine these measures into a single measure by predicting enrollment at community college based on demographic characteristics. In Table 5 this appears as ”Linear Prediction” and is shown to be unrelated to annexation. The coefficient implies that based on demographics alone there would be an expected increase in enrollment at community college of .22 pp.

I also consider whether annexation is related to high school graduation by using a

[29]This exercise is explained in more detail in Section IV.B.

[30]I restrict the sample to already included districts and an annexed district. If two K-12 districts are annexed in the same year I combine them into one group to test for parallel trends

[31]A similar exercise is performed using student demographic data. I predict community college enrollment using demographic information and check for differential trends in enrollment probabilities. In this case, one additional annexation event for Cypress-Fairbanks and Magnolia finds a differential trend in demographics at the 5 percent level. The exclusion of Cypress-Fairbanks and Magnolia does not substantially alter the results.

[32]One potential confounder would be a change in the admissions policies of community colleges that coincided with annexation. This is a potential problem in a selective college setting, but because community colleges are open-enrollment this is not an issue. If community colleges changed in quality after annexation this increased quality would affect both the treatment and control districts.

sample of 10th graders and find no relationship between annexation and the probability of graduating from high school in Table 5.[33] Lastly, there is a marginally statistically significant increase in the probability that high school graduates reply that they do not have college plans when asked. The implications of no change (or possibly a positive change) in having no college plans will be discussed further in the results section. Overall, Table 5 presents evidence that student characteristics were not observably different by annexation status. This evidence lends credibility to the assumption that there were no simultaneous changes at the time of annexation.

A further test that the timing of annexation is unrelated to other factors is to consider annexation attempts that failed which appears in . The results from this exercise suggest that simply holding an annexation vote does not affect college enrollment. This result is discussed further in Appendix E.

In order for the estimates of b in Equation 3 to reveal the effect of community college tuition on enrollment several assumptions for instrumental variable estimation need to hold. The first is that annexation is strongly related to tuition. Annexation is a policy that intentionally changes the tuition and so this should be true. Table 4 examines the impact of annexation on the sticker price of tuition and finds that annexation reduces tuition by $1140. This reduction is verified visually in Panel A of Figure 3 where annexation results in a substantial drop in tuition by approximately 50 percent.

Tables 4 and 5 about here

I must also assume that annexation is correlated with community college tuition but is not related to any other factors that would influence enrollment behavior. Ultimately this exclusion restriction is untestable, but controlling for the factors that are most likely to vary at the county/community college district level as previously outlined helps alleviate potential problems. One change of particular interest may be the changing of services offered by community colleges which I attempt to capture using indicators for new campuses being built and by the inclusion of community college district-by-year fixed effects.

B. Enrollment Results

Table 6 contains the estimates of the effect of annexation on immediate community college enrollment. Columns 1-4 present the effect of annexation on enrollment patterns. Controls are gradually added until the preferred specification in column 4 which includes year, K-12 district fixed effects, demographic characteristics, indicators for new campuses, and college by year fixed effects. The results in columns 1-3 are presented

[33] I define the annexation variable for these students as cohorts who will experience an annexation in their senior year rather than in their tenth grade year. A special consideration is that students may change their graduation plans in response to annexation. Graduation plans would be difficult for students to change as annexation is announced during a student's senior year, but I can test for this directly. The probability of graduation does not change for cohorts that will be annexed. This means that using the sample of high school graduates does not suffer from the sample selection related to annexation. Interestingly, students are asked whether they plan to attend college and this variable does not change with annexation. The implications of this finding will be discussed in the Section IV.B.

for completeness and show that the inclusion of various control variables do not substantively change the variable of interest. Column 5 estimates Equation 3 and presents the change per $1,000 in sticker tuition at the local community college. Column 6 estimates an elasticity by collapsing the data into K-12 district by year cells and running a regression of log enrollment where log tuition is instrumented using an indicator for annexation.[34] There are four panels representing different outcomes, immediate enrollment at a community college, university, the in district community college, and no enrollment at any college or university in the sample.

Panel A of Table 6 shows that annexation is associated with a 3.2 pp increase in community college attendance, which is a 12 percent increase over the sample average. Panel B examines the effect of annexation on enrollment at four-year universities. In the preferred specification there is a very small point estimate of -.05 pp that is not statistically significant suggesting no impact of annexation on public, four-year enrollment.[35] However, the confidence interval for university enrollment includes modestly sized decreases and increases in four year enrollment.

To test whether the local community college's price is the relevant price for community college for most students, I compare the estimated effects of enrollment in any community college in Panel A of Table 6 to the effects of in-district enrollment found in Panel C 3 of Table 6.[36] If students could easily switch enrollment between community colleges, annexation might have zero effect on enrollment in community college but a large increase in enrollment in-district. The estimated annexation effect is larger for enrolling in-district at 4.4 pp than for enrolling in any community college which is 3.2 pp. The discrepancy in magnitudes indicates annexation induced some students to switch enrollment in community college from out-of-district to the community college that was closest to home. Ultimately this switching should only bias the estimates of tuition's effect on community college enrollment downward as it is an indication that the local community college's tuition may not be the relevant tuition for a subset of students.

Table 6 about here

Column 4 in Panel A of Table 6 examines the effect of annexation on the decision to not enroll in any public college in the data. High school graduates are 3.1 pp less likely to not attend college as a result of annexation–that is, students were 3.1 pp more likely to attend college with all of the increase occurring at community colleges. An important caveat with these results is that private universities and colleges are not observed. Students may be switching enrollment from private two-year colleges to public community colleges. Notably, Cellini (2009) finds that additional funding for public community

[34] When using collapsed data, the cells are weighted by the number of high school graduates.

[35] To this point all estimates have included an indicator not only for annexation but also for a new building. As a robustness check, Equation 1 is estimated but only using annexations that did not see a new campus built. The estimate in the preferred specification with controls for demographics as well as year, K-12 district, and college by year fixed effects is higher at .0397 pp with a standard error of .012. This estimate includes the estimate for all annexations in the confidence interval and suggests that using an indicator for new buildings does not substantively affect the results.

[36] For cohorts that were not in district at the time of high school graduation this is defined as the community college into which their K-12 district would eventually be annexed.

colleges causes a small reduction in the number of proprietary schools. However, the the reduction in the number of proprietary schools is hard to translate into a number of students diverted by reduced tuition.

Unfortunately, data on for private two-year colleges has only recently been collected by the Texas Higher Education Coordinating Board (THECB). However, the THECB estimated that students at private (either for profit or not for profit) two-year colleges represented just 3 percent of state college enrollment in 1999 as compared to public community colleges which represented 44 percent (Texas Higher Education Coordinating Board, 2001). In fact, if *all* students switched from private two-year colleges to community colleges that would only account for approximately 60 percent of the measured effect. Ultimately, I cannot distinguish between no enrollment and enrollment at private two year colleges. However, given the size of the private two year sector in Texas at the time it seems likely that the majority of increased community college enrollment came from students who would not have enrolled in college otherwise rather than diverting students who would enroll in the private two year sector.[37]

Another important result for interpretation is the combination of the estimated enrollment effects and the lack of effects found on stated college intentions in Column 9 of Table 5. This suggests that several students had planned on going to college who would not have enrolled except for changes in community college costs. Lowering tuition costs did not affect college plans but allowed students who had a stated interest in college attendance to enroll.

Taken together, these results indicate that the reduced tuition associated with annexation resulted in students attending community college at higher rates. The increase appears to have come from students who would not have attended college in the absence of reduced community college tuition. This can be inferred because enrollment at public unviersities did not change. The lack of a change in university enrollment combined with a monotonicity assumption that reduced community college tuition did not induce some students to switch enrollment from no enrollment to unviersity enrollment yield insight into who responds to reduced community college tuition. Specifically, these results suggest that reducing tuition increased community college enrollment among students who would not have enrolled in absence of reduced tuition rather than diverting students from the four year sector to the community college sector.

To scale the results by the changes in sticker tuition, Equation 3 is estimated and results are presented column 5 of Table 6, where the effect of community college tuition is in $1,000s of dollars. A $1,000 increase in the annual sticker price of tuition decreases community college attendance by 2.8 pp. It also decreases enrollment in-district by 3.8 pp and increases the fraction of students enrolling in no college by 2.8 pp. As there are not large changes in financial aid, the change in sticker price is likely to reflect the true tuition bill for students who experienced annexation. However, sticker price is measured with error which needs to be corrected.

[37] A more recent estimate for IPEDSs from the 2006-07 school year suggests that public colleges and universities constitute 85 percent of total enrollment. Private 4 year colleges represent 8.5 percent of enrollment. These colleges are captured in the data in later years and I find no evidence of a decrease in the probability of attending private four year colleges. The remainder are private for-profit universities and colleges which represent 6.6 percent of total enrollment.

As previously discussed, the results should be scaled by the change in the fraction of students eligible for in-district tuition which was measured as .55. Using this information a decrease of $1,000 in tuition per semester would lead to an increase in immediate community college enrollment for high school graduates of 5.1 pp. This is slightly higher than estimates of the effect of financial aid on college attendance. There are at least two possible reasons for a slightly higher estimate. The first is that the actual change in the costs of college is observed relatively well in this study, so appropriate adjustments can be made for measurement error. The second reason is that students on the margin of attending community college may be more price sensitive than the entire population of potential college goers.

The estimates thus far have been in terms of the enrollment rate to aid comparability with prior estimates in the literature. An alternate approach is to estimate Equation 3 but to use the natural logarithm of Y_{cdt} and $Tuition_{dt}$. This specification yields estimates of the elasticity of enrollment with respect to community college tuition. An elasticity has the benefit of being unitless and allows comparisons across time and context. In order for these estimates to be unbiased, there is an additional assumption required that the change in the magnitude of tuition must be unrelated to latent demand for community college. This assumption is supported by institutional features of Texas community colleges. Community colleges can charge basically two prices–in district and out of district. These two prices are set by the community college and apply to several municipalities, as such it is impossible for a college to promise a different sized tuition discount for each municipality.[38] This feature provides support for the idea that the size of the reduction in tuition is unrelated to latent demand.

The column labeled "Elasticity" in Table 6 contains these elasticity estimates. The Enroll CC row indicates that a 10 percent increase in community college tuition would lead to a 1.6 percent decrease in community college enrollment, or 2.9 percent if scaled by the change in in-district tuition payment. The Enroll University row confirms that an increase in tuition does not affect enrollment at public four-year universities. The enroll in district row indicates that the elasticity is higher for in-district enrollment as previously discussed. Finally, the final row explores no enrollment at any public university or college and indicates that a 10 percent increase in community college tuition increases the probability that a student is not attending any college by .98 percent, or 1.8 percent when accounting for payment of in-district tuition.

Figure 5 depicts the elasticity results visually. Equation 1 is estimated on log enrollment and log tuition excluding the indicator for annexation. The binned residuals confirm visually the pattern that is seen in the regressions. Importantly, the results on the relationship between community college tuition and community college enrollment looks basically linear showing that bigger reductions in tuition lead to bigger enrollment increases. Panel B confirms the finding that there does not seem to be a strong relationship between community college tuition and public four year enrollment.

[38] Also, if there is any ability for a college to set the price differentially based on latent demand, the college's incentive would be to give a smaller discount to areas that had higher latent demand. However, the negative and roughly linear relationship between residual log tuition and enrollment in Figure 5 is suggestive evidence that price is the dominant driver of the change in enrollment. This relationship need not be negative if other factors are driving enrollment.

EFFECTS BY COHORT RELATIVE TO ANNEXATIONTo examine the timing of these effects a model is estimated with indicator variables for cohorts relative to annexation instead of a single annexation indicator in an event study framework.[39] This gives a sense of when enrollment patterns changed and if pre-existing trends are driving the results. The coefficients are plotted in Figure 4 along with 95 percent confidence intervals; the omitted category is for the cohort one year prior to annexation. Prior to annexation, treatment and control groups appear to have similar trends in community college enrollment as can be seen by a flat difference in years prior to annexation. Also, in four of the five years prior to annexation, the 95 percent confidence interval contains zero which means that in those years, the difference between treatment and control groups cannot be distinguished from what it was in the year before annexation. If there were differential trends the levels of the plotted coefficients would exhibit a trend. Five years before annexation there appears to be a one time deviation from a flat trend, but in the four years leading up to annexation there does not appear to be any trend.

Figure 4 about here
Figure 5 about here

There is a jump in the probability of attending community college in the year of annexation, and by the second cohort after annexation treated districts are statistically significantly more likely to attend community college attendance relative to the control districts. The effects are largest after three years and seem to stabilize in years 3-5 after annexation.[40] A similar exercise for enrollment in university is performed in Panel B of Figure 4 for enrollment in university though there does not appear to be any change in university enrollment.

Due to this pattern where the effect grows over time, a separate specification run where the annexation variable is split into a variable for being the first three cohorts after annexation and another indicator for the fourth and later cohorts. In these specifications, the effect in the first three years is reduced to .03 with a standard error of .0055. For cohorts four years or more after annexation the estimated increase is .053 with a standard error of .0067. If this estimate is scaled up in a similar way as before it indicates that the long run effect of a $1,000 change in tuition results in a 8.7 percentage point increase in enrollment. This larger estimate represents what would be expected for a $1,000 decrease in community college tuition in the long run.

LONGER TERM ENROLLMENTTo this point immediate enrollment in the fall after high school has been the focus of the estimation. However, enrollment patterns beyond the fall following high school graduation are interesting as well. When examining year two after high school, some students who did not experience reduced community college

[39]Cohorts beyond five years after annexation are combined into one indicator for five years or greater. Cohorts six years or greater before annexation are similarly combined.

[40]The gradual increase in the estimated effects of annexation could happen for a few reasons, but one potential explanation that is consistent is a salience story where students may not be entirely aware of the change in community college price but as time passes information is diffused.

tuition directly after high school graduation had exposure to lower community college tuition two years after high school graduation. The more years pass after high school, the greater the portion of the control group that has some level of treatment increases so effects in the later years should be attenuated.

Panel A of Table 7 examines community college enrollment in the years after high school. The dependent variable is a binary indicator with unity if the student enrolled in community college in each calendar year after their high school graduation.[41] In all years students are more likely to be enrolled in community college with the largest estimates being in the years directly after high school. The magnitude gets smaller over time but is fairly constant at around a 10 percent increase over the baseline attendance rate in that year. Taken together these results indicate that reduced tuition induces high school graduates to attend community college immediately and continues to affect enrollment for several years after high school. The effects past the first year can come through either increased persistence in college or increased first time enrollment at older ages.[42] This is also depicted in Figure 6 Panel A.

Figure 6 about here Table 7 about here

Panel B of Table 7 and Figure 6 Panel B performs a similar exercise considering enrollment at a public university in each year since high school. In the first three years after high school graduation, students do not appear to be more likely to attend a four-year university if they experience an annexation. However, starting in year four after high school, the coefficients increase in magnitude and in years four to six after high school the estimated coefficients are statistically significantly different from zero. This is exactly the pattern that would be expected if initial attendance at a community college translated into additional enrollment at universities via transfer.

The evidence on enrollment suggests that reduced community college tuition has a democratization effect and no diversion effect. Reduced community college tuition induced students who would not have attended college of any type to enroll in community colleges. This quasi-experimental evidence on the effect of community college access on enrollment suggests that reduced community college tuition increases college attendance but does not reduce university enrollment.

Overall, these results indicate that students respond to a $1,000 decrease in community college tuition by increasing immediate community college attendance by 5.1 pp, or a 20 percent increase over the baseline with a long run impact of 8.7 pp. Students do not appear to switch their enrollment from universities to enroll in community college but instead switch from not enrolling in college to enrolling in community college.

[41] To account for observed pattern where the effect of annexation varies by the year since annexation, indicators for years after annexation are also included as controls.

[42] Further consideration of longer term attendance is considered in Appendix C which examines credit hours attempted.

V. Educational Effects of Community College

A. *Identification*

Knowing the relationship between community college access and long term educational outcomes is difficult because students who attend community college are likely to be unobservably different from students who do not. In order to overcome this challenge, a source of variation is needed that influences community college attendance but does not directly influence long term outcomes. For the second part of my analysis, I use community college taxing district annexations as an instrument for community college attendance to identify the effects of community college attendance on educational attainment. Annexation has been shown to strongly influence community college attendance and induces students to attend community college who would not have attended college otherwise.

For this analysis, I am estimating the following first stage equation using high school graduates from 1994-2005. The familiar indicator for annexation, $Annexation_{dt}$ is an instrument for attendance at a community college in the first year after high school $AttendCC_{dt}$:

$$AttendCC_{dt} = \varsigma \cdot Annexation_{dt} + X_{dt}\phi + W_{ct}\chi + \vartheta_d + \delta_t + \omega_{ct} + \mu_{cdt} \tag{4}$$

The second stage equation becomes:

$$Y_{cdt} = f \cdot \widehat{AttendCC}_{dt} + X_{dt}\kappa + W_{ct}\rho + \pi_d + \zeta_t + \lambda_{ct} + \upsilon_{cdt} \tag{5}$$

Y_{cdt} is an education outcome like graduation from a community college college. The indices are the same as prior estimating equations with c indexing community college taxing district, d indexing K-12 school district, and t indexing time. As before, these specifications include year fixed effects, K-12 district fixed effects, and community college district by time fixed effects as well as controls for demographic characteristics.

For this instrumental variables strategy to be valid there are several assumptions that need to be made. First, the instrument must be strongly correlated with attending community college. Section IV established that annexation is strongly correlated with community college attendance. Second, the exclusion restriction states that the instrument must not be correlated with longer term outcomes like bachelor's degree receipt except through community college attendance.

A potential violation of the exclusion restriction is if cheaper community college tuition affects students who would have attended community college anyway by giving them access to reduced tuition. In order to test this an indicator for the cohort prior to annexation is included. These students would have access to cheaper community college tuition in all but the first year of attendance. This indicator is statistically insignificant and very small suggesting that access to cheaper community college for students who would have attended community college in the presence of higher tuition did not affect graduation probabilities. This result supports the assumption of the exclusion restriction.

The full results from this exercise are available upon request.[43] Ultimately, the reduced form impacts of decreased community college tuition on educational attainment are still interpretable even if the exclusion restriction does not hold.

As with any instrumental variables estimation, the local average treatment is important to consider. In this case, annexation was shown to induce students to attend community college who would not have enrolled in any college otherwise. Knowing this, f is the effect of attending a community college for students who would not have any college in the absence of reduced tuition.

B. Educational Attainment Results

Panel A of Table 8 explores the effect of annexation on graduation probabilities from community college as well as universities. Column 1 of Panel A considers graduation from a community college with a degree or certificate and does not find any effect of annexation on degree or certificate receipt. Column 2 of Panel A considers graduation with a community college credential or degree after 4 years and finds no effect. Likewise, annexation is not associated with increases of bachelors' degree receipt in 4, 6, or 8 years after high school graduation which are explored in the Appendix F though the estimates lack precision.

Table 8 about here

Panel C of Figure 4 considers graduation from a community college in four years by cohort relative to annexation. Graduation appears to have increased slightly in the years after annexation but not dramatically so. This confirms the results in Panel A of Table 8 which found no effect on graduation outcomes but had positive point estimates.

To consider the effect of attending a community college on ultimate degree receipt and to scale by the first stage, Equation 5 is estimated. The results are very similar to what has been discussed previously but scales the results by the fraction of students who attended a community college in the first year after high school graduation. The results from this instrumental variables estimation are in Panel B of Table 8. The results are statistically imprecise but the point estimates can be instructive.

There does not appear to be a significant change in the fraction of students receiving a degree or certificate from a community college within four years. This is somewhat surprising as reduced tuition significantly increased enrollment. Unfortunately, the standard errors cannot rule out reasonably large changes in degree or certificate receipt. In the entire sample, recent high school graduates are very unlikely to receive a community college degree or certificate with only 4 percent receiving any degree or certificate from a community college within four years after high school graduation. Moreover, students who were induced to enroll via reduced tuition may have entered with the intention of

[43] Another potential violation arises from the result from section IV.B that showed that some students change their enrollment from attending a farther-away community college to the now-in-district community colleges. If community colleges have different probabilities of affecting bachelor's degree this could be problematic. However, Stange (2012) presents evidence that community college quality does not significantly impact bachelor's degree attainment.

transferring. Nearly half of students induced to enroll transferred which suggests that many of the marginal entrants into community colleges intended on transferring.

An oddity arises in graduation from a community college within two years where there is a marginally statistically significant decrease in the probability of graduation from a community college within two years. This may be because graduation is measured as completing any degree from a community college and students switch from shorter certificate programs to longer degree programs. It is also worth noting that only 1.1 of high school graduates graduate with a community college degree or certificate within 2 years of high school and so the reduced form is a very small decrease of -.002.

For comparison's sake a cross-sectional OLS regression is presented in Panel C of Table 8. As one example of the cross sectional correlation, 7.5 percent of students who attend a community college in the first year after high school graduation receive a degree or certificate from a community college within 4 years of high school graduation. These estimates suggest that four year graduation patterns of students induced to attend a community college due to annexation presented in Panel B of Table 8 look similar to correlations of community college attendance with educational attainment. Put another way, marginal entrants into community college look similar to average community college students in terms of their graduation patterns.

Table 9 further explores this result by examining transfer from community colleges to universities. For each year after high school graduation I define transfer as if a student is enrolled in a university in the current year and had been enrolled in a community college in a prior year. In years three to six after high school, students are more likely to be at universities with prior attendance at community colleges. These results suggest that reduced tuition for community colleges induces students to initially enroll in community colleges and eventually attend four-year universities after attending community college.

Table 9 about here

VI. Heterogeneity

This section examines the heterogeneous effects of reduced community college tuition on enrollment in addition to the heterogeneous effects of community college attendance on educational attainment by race, gender, and economic disadvantage status. Table 10 contains estimates for the enrollment effects as well as the reduced-form effects for educational attainment. In these analyses, I employ a fully interacted model where indicators for race, gender, or economic disadvantage status are interacted with every variable in Equation 1. The effect for a given group is the sum of the main coefficient and the coefficient interacted with the the group indicator.

Table 10 about here

I will only discuss the results that have statistically different results by gender, economic disadvantage, or race while all others are statistically indistinguishable. For immediate enrollment in community college, African American students respond more strongly to annexation than white students. African American students also respond

to annexation by diverting enrollment from universities to community college. African American and males see a marginally statistically significant increase in graduating with a degree or certificate from a community college.

The measured diversion effect for African American students stands in contrast to the results for the whole sample where there was no switching from universities to community colleges. Appendix F explores the heterogeneous effects of annexation on bachelor's degree completion.

VII. Back of the Envelope Calculation

The results of this paper can help inform what might happen when there are drastic cuts in community college tuition like the proposed America's College Promise. A few important caveats exist in taking the results of this paper and extrapolating to what might happen if a plan for free community college were enacted. First, Texas is different from the rest of the country in that the community college tuition is relatively low and attendance at community colleges is relatively high which is also true in the five community colleges in this study. Second, the exact nature of the change in tuition is important, America's College Promise is a first-dollar proposal which means that students would continue to receive other federal aid such as the Pell Grant. The College Board estimates that the grant and tax aid exceed tuition at community (The CollegeBoard, 2015).[44] This was not the case in Texas during the time studied where the net price was greater than zero. If reductions in the price of attending community college are different when the net price is positive and zero/negative, the results of this paper may not apply. Also, America's College Promise proposes a change in tuition of approximately $3,800. This is substantially more than the observed change in tuition in this paper of $1,140 which so the local estimates in this study may not full translate. Lastly, shifting pricing to "free college" might have different effects than reducing tuition by 50 percent. This might happen for behavioral reasons around a price of zero (Shampanier, Mazar and Ariely, 2007) or for messaging reasons about the promise of free college. All of this is to say that this policy simulation has many caveats. The elasticity estimated in this paper suggests that a 100 percent decrease in tuition such as America's college promise would yield a 29 percent increase in enrollment among recent high school graduates at community colleges. For high school graduates in 2015 this would represent roughly an additional 102,000 students.[45]

VIII. Conclusion

This paper presents evidence on the price sensitivity of community college enrollment as well as the long term consequences of community college enrollment. Using variation in tuition at community colleges in Texas caused by the expansion of community

[44]Even after removing tax aid, the net price is close to zero. (Monaghan and Goldrick-Rab, 2016)

[45]This uses the BLS's estimate of 354,000 recent high school graduates enrolling in community college. (Bureau of Labor Statistics, 2016)

college taxing districts and administrative data, I find that students respond to changes in community college tuition at a higher rate than the rate at which prior studies have measured responses to grant aid. Overall, students do not switch from four-year college to community college as a result of price decreases but rather switch to attending from not enrolling in college. However, there is important heterogeneity by race in the response to reduced community college tuition with African Americans initially diverting attendance from universities to community colleges.

For students induced to attend community college, the estimated changes in degree completion appear roughly the same as the cross sectional correlations between community college enrollment and degree completion. This paper provides quasi-experimental evidence on the democratization versus diversion effect of community college and finds evidence supporting a democratization effect for community college.

The Texas experience studied provides insight into the potential effects of reduced community college tuition on the enrollment and educational attainment of proposals that would reduce community college tuition. A $1,000 in community college tuition leads to larger increases in attendance than the same increase in financial aid primarily used at four year universities. This is likely to be because students at community colleges have different price sensitivity but also may be because the studied policy changed sticker tuition rather than financial aid.

These findings can speak directly to current policy debates on reducing community college tuition. Namely, the diversion from four year to two year colleges as a result of community college tuition decreases is likely to be small relative to the increases in community college enrollment. Additionally, students induced to attend community college appear to graduate at similar rates as the average student attending a community college.

References

Bailey, Thomas, Davis Jenkins, and Timothy Leinbach. 2005. "What We Know about Community College Low-Income and Minority Student Outcomes: Descriptive Statistics from National Surveys." *Community College Research Center*.

Bettinger, Eric P., Bridget Terry Long, Philip Oreopoulos, and Lisa Sanbonmatsu. 2012. "The Role of Application Assistance and Information in College Decisions: Results from the H&R Block Fafsa Experiment." *The Quarterly Journal of Economics*, 127(3): 1205–1242.

Betts, Julian R, and Laurel L McFarland. 1995. "Safe port in a storm: The impact of labor market conditions on community college enrollments." *Journal of Human Resources*, 741–765.

Bound, John, and Sarah Turner. 2007. "Cohort crowding: How resources affect collegiate attainment." *Journal of Public Economics*, 91(5): 877–899.

Bureau of Labor Statistics. 2016. "College Enrollment and Work Activity of 2015 High School Graduates Technical Note."

Carruthers, Celeste K., and William F. Fox. 2016. "Aid for all: College coaching, financial aid, and postsecondary persistence in Tennessee." *Economics of Education Review*.

Castleman, Benjamin L., and Bridget Terry Long. n.d.. "Looking beyond Enrollment: The Causal Effect of Need-Based Grants on College Access, Persistence, and Graduation." *Journal of Labor Economics*, Forthcoming.

Cellini, Stephanie Riegg. 2009. "Crowded Colleges and College Crowd-Out: The Impact of Public Subsidies on the Two-Year College Market." *American Economic Journal: Economic Policy*, 1(2): pp. 1–30.

Cohodes, Sarah R, and Joshua S Goodman. 2014. "Merit aid, college quality, and college completion: Massachusetts' Adams scholarship as an in-kind subsidy." *American Economic Journal: Applied Economics*, 6(4): 251–285.

Cornwell, Christopher, David B Mustard, and Deepa J Sridhar. 2006. "The Enrollment Effects of Merit-Based Financial Aid: Evidence from Georgias HOPE Program." *Journal of Labor Economics*, 24(4): 761–786.

Deming, David J., and Susan Dynarski. 2010. "Into College, Out of Poverty? Policies to Increase the Postsecondary Attainment of the Poor." University of Chicago Press.

Dynarski, S. 2004. "The New Merit Aid." *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, 63.

Dynarski, Susan. 2000. "Hope for Whom? Financial Aid for the Middle Class and Its Impact on College Attendance." *National Tax Journal*, 53(3): 2–61.

Dynarski, Susan, and Mark Wiederspan. 2012. "Student aid simplification: Looking back and looking ahead." *National Tax Journal*, 65(1): 211–234.

Dynarski, Susan M. 2003. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." *The American Economic Review*, 93(1): 279–288.

Gillen, Andrew, Jonathan Robe, and Daniel Garrett. 2011. "Net Tuition and Net Price Trends in the United States." *Center for College Affordability and Productivity*.

Goodman, Joshua. 2008. "Who merits financial aid?: Massachusetts' Adams scholarship." *Journal of Public Economics*, 92(10): 2121–2131.

Hilmer, Michael J. 1997. "Does community college attendance provide a strategic path to a higher quality education?" *Economics of Education Review*, 16(1): 59–68.

Jepsen, Christopher, and Mark Montgomery. 2009. "Miles to go before I learn: The effect of travel distance on the mature person's choice of a community college." *Journal of Urban Economics*, 65(1): 64–73.

Kane, Thomas J. 1995. "Rising public college tuition and college entry: How well do public subsidies promote access to college?" National Bureau of Economic Research.

Kane, Thomas J, and Cecilia Elena Rouse. 1999. "The community college: Educating students at the margin between college and work." *The Journal of Economic Perspectives*, 13(1): 63–84.

Kane, Thomas J, Stephanie K Riegg, and Douglas O Staiger. 2006. "School quality, neighborhoods, and housing prices." *American Law and Economics Review*, 8(2): 183–212.

Martorell, Paco, Brian McCall, and Isaac McFarlin. 2014. "Do Public Tuition Subsidies Promote College Enrollment? Evidence from Community College Taxing Districts in Texas." US Census Bureau Center for Economic Studies Paper CES 14-32.

McFarlin, Isaac. 2007. "Do Public Subsidies Promote College Access and Completion? Evidence from Community College Districts."

Miller, Darwin W. 2007. "Isolating the Causal Impact of Community College Enrollment on Educationalm Attainment and Labor Market Outcomes in Texas." *Stanford Institute for Economic Policy Research Discussion Paper 06-33*.

Monaghan, David, and Sara Goldrick-Rab. 2016. "Is Community College Already Free?" Wisconsin Hope Lab.

National Center for Education Statistics. 2014. "Digest of Education Statistics: 2013."

Nunez, Anne-Marie, and C. Dennis Carrol. 1998. "First-Generation Students: Undergraduates Whose Parents Never Enrolled in Postsecondary Education." *National Center for Education Statistics*.

Nutting, Andrew W. 2008. "Costs of attendance and the educational programs of first-time community college students." *Economics of Education Review*, 27(4): 450–459.

Rouse, Cecilia Elena. 1994. "What to do after high school: The two-year versus four-year college enrollment decision." *Choices and consequences: Contemporary policy issues in education*, 59–88.

Rouse, Cecilia Elena. 1995. "Democratization or diversion? The effect of community colleges on educational attainment." *Journal of Business & Economic Statistics*, 13(2): 217–224.

Scott-Clayton, J. 2011. "On Money and Motivation A Quasi-Experimental Analysis of Financial Incentives for College Achievement." *Journal of Human Resources*, 46(3): 614–646.

Seftor, Neil S, and Sarah E Turner. 2002. "Back to school: Federal student aid policy and adult college enrollment." *Journal of Human Resources*, 336–352.

Shampanier, Kristina, Nina Mazar, and Dan Ariely. 2007. "Zero as a special price: The true value of free products." *Marketing science*, 26(6): 742–757.

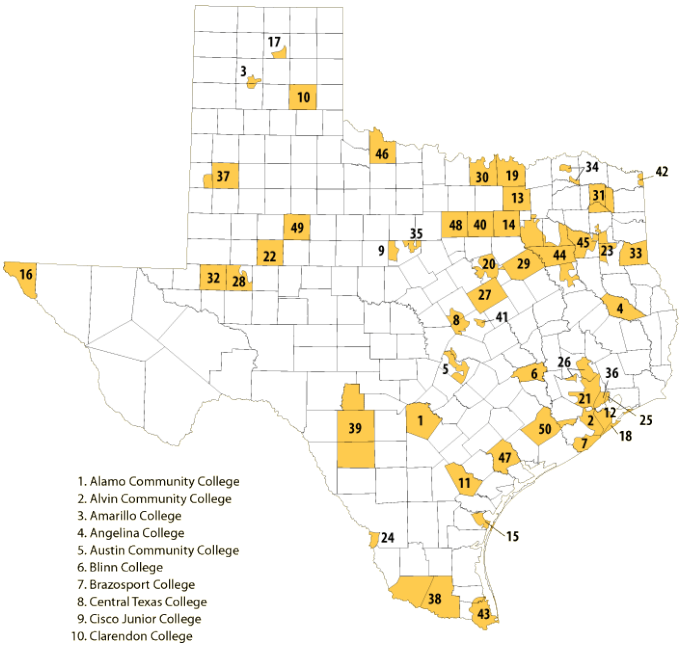
Stange, Kevin. 2012. "Ability sorting and the importance of college quality to student achievement: Evidence from community colleges." *Education Finance and Policy*, 7(1): 74–105.

Texas Higher Education Coordinating Board. 2001. "Closing the Gaps: The Texas Higher Education Plan."

The CollegeBoard. 2015. "Trends in College Pricing 2015." College Board.

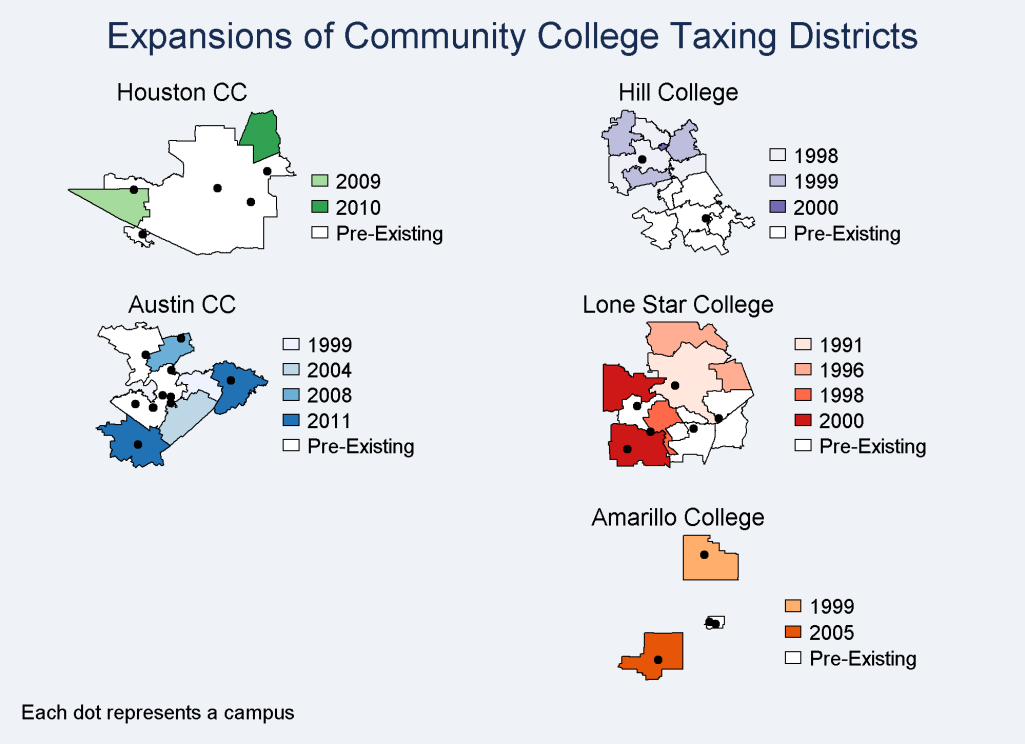
Turner, Nicholas. 2011. "The Effect of Tax-based Federal Student Aid on College Enrollment." *National Tax Journal*, 64(3): 839–862.

FIGURE 1. TEXAS COMMUNITY COLLEGE TAXING DISTRICTS



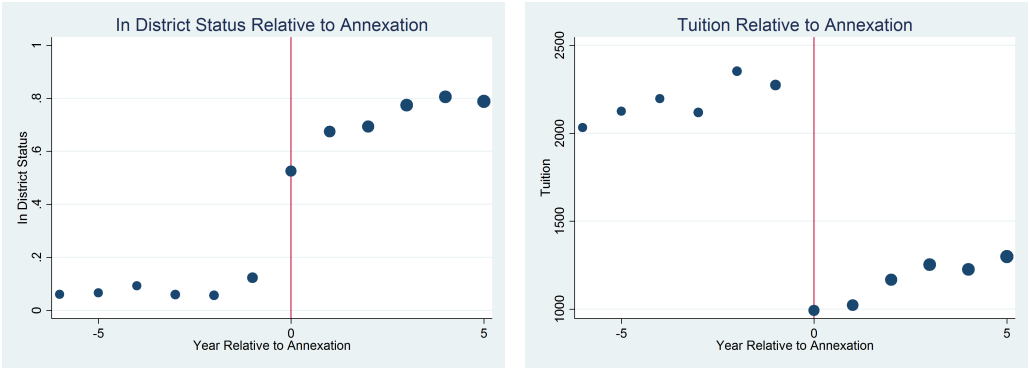
Note: Source: Texas Association of Community Colleges, 2008. This figure highlights the areas in Texas included in a community college taxing district in 2008.

FIGURE 2. TEXAS COMMUNITY COLLEGE EXPANSIONS



Note: Each panel represents the taxing district of a distinct community college in Texas. The boundaries in the figures represent K-12 school district boundaries and the colors indicate when the K-12 district was annexed. K-12 districts that have no color were included in the community college taxing district prior to the start of the data.

FIGURE 3. CHANGE IN COST

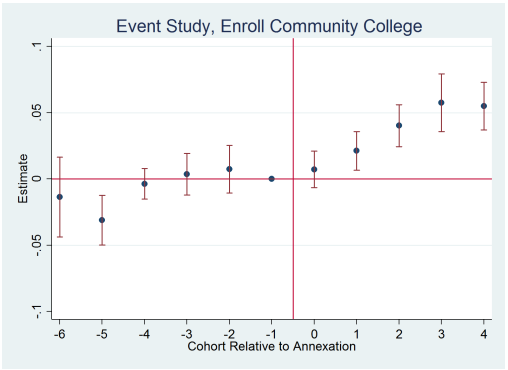


(a) In-District Status (b) Tuition

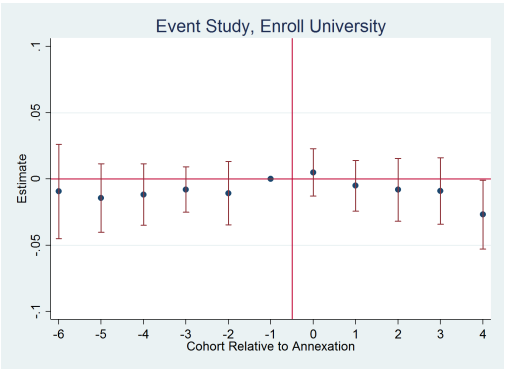
Note: Panel A plots the fraction of students in a K-12 cohort paying in-district tuition at the local community college among students who attended community college. Each dot represents a cohort re-centered by its annexation date. The size of the dot is proportional to the number of students attending community college in that re-centered year. Only K-12 districts that experience an annexation are included in this figure.

Panel B is a plot of the tuition and fees for two semesters of 12 credits paid by student at the local community college relative to annexation. For comparability, only schools that had five years prior to annexation and five years after were included.

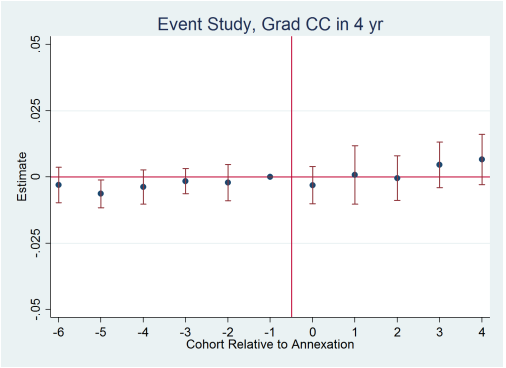
FIGURE 4. EVENT STUDIES FOR ANNEXATION



(a) CC Enrollment



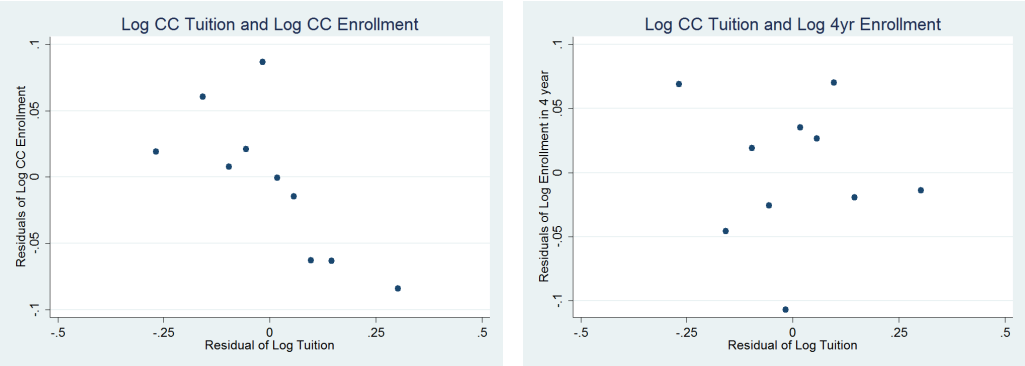
(b) 4yr Enrollment



(c) Grad CC, 4 yrs

Note: These figure plots the coefficients of a regression that compares differences in student outcomes between annexed districts and districts that were already part of the taxing district. The results are split by cohort relative to the annexation event occurring. Panel A considers immediate enrollment in community college. The horizontal axis represents the cohort relative to annexation. For instance, 0 represents the cohort that first experienced annexation. -6 includes all cohorts 6 years or more before annexation. 4 includes all cohorts 5 years or more after annexation. Panel B considers immediate enrollment at a university, and Panel C examines receiving a degree or certificate from a community college in 4 years. The regression that produces these differences also controls for demographic characteristics, year fixed effects, K-12 district fixed effects, college-by-year fixed effects, as well as the building of a new campus.

FIGURE 5. BIN SCATTER PLOTS



(a) CC Enrollment (b) 4yr Enrollment

Note: These figures plot the binned residuals of a regression of log enrollment in equation 1 with the annexation indicator excluded against the same regression that predicts log tuition. A linear prediction of the bins is also plotted.

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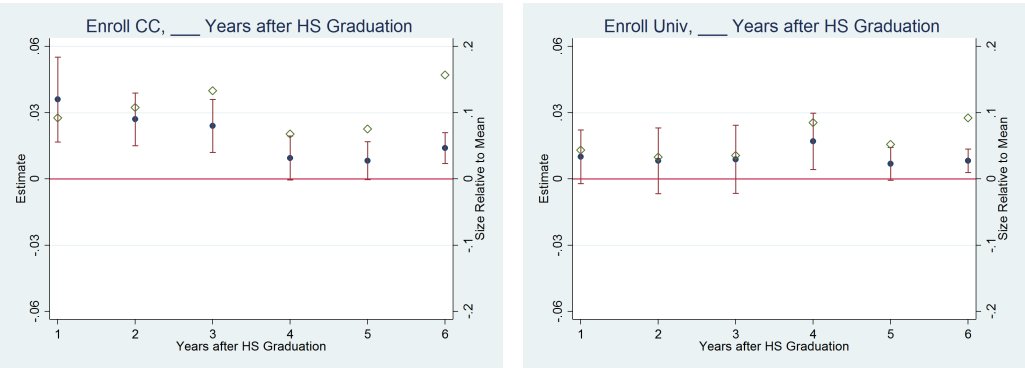
FIGURE 6. ENROLLMENT YEARS AFTER HS GRADUATION



(a) CC Enrollment (b) 4yr Enrollment

Note: This table considers longer term enrollment patterns of annexation. The circles represent the estimates from regressions on whether a student enrolled in a community college for different years after high school graduation. The hollow diamonds represent the size of the effect divided by the sample mean for the outcome variable. The regressions include controls for year and district fixed effects, demographic characteristics including race and gender, college by year fixed effects, and indicators for new campuses. All results use high school graduates from 1994-2005. Standard errors are clustered at the K-12 district level and are depicted using 95 percent confidence intervals. The horizontal axis is the years that have elapsed since high school graduation. For year 1, this would be if a student enrolls in the Fall, Spring, or Summer semester immediately after their high school graduation.

TABLE 1—EXPANSIONS OF COMMUNITY COLLEGE TAXING DISTRICTS

Austin Community College

District	*Expansion of Taxing District*	*New Building*
Manor	1999	1999
Del Valle	2004	
Round Rock	2008	2010
Elgin	2011	2013
Hays	2011	2014

Lone Star College

District	*Expansion of Taxing District*	*New Building*
Conroe	1991	1995
Willis	1996	
Splendora	1996	
Klein	1998	2011
Cypress-Fairbanks	2000	2003
Magnolia	2000	

Amarillo College

District	*Expansion of Taxing District*	*New Building*
Hereford	2005	2005
Dumas	1999	2001

Hill College

District	*Expansion of Taxing District*	*New Building*
Rio Vista	1999	2000
Keene	2000	2000
Joshua	1998	2000
Grandview	1998	2000
Godley	1999	2000
Cleburn	1998	2000
Alvarado	1999	2000

Houston Community College

District	*Expansion of Taxing District*	*New Building*
Alief	2009	2008
North Forest	2010	

Note: This table outlines the expansions to the five community colleges that experience annexations of municipalities into taxing districts during the time contained in the data. Each row containts a K-12 District, the year of annexation and the year of building a new campus (if any). See Appendix A for details on the collection of these dates.
Source: Collected by the author, see Appendix A for details

TABLE 2—SUMMARY STATISTICS

	Mean	SD	N
Enrolled in CC, Fall	0.27	0.44	204,448
Enrolled in 4yr, Fall	0.25	0.43	204,448
Enrolled In-District, Fall	0.21	0.41	204,448
Enrolled in CC, Full Year after HS	0.39	0.49	204,448
Enrolled in yr, Full Year after HS	0.23	0.42	204,448
Did Not Enroll	0.49	0.50	204,448
Pays In District Tuition	0.71	0.45	54,401
Post Annexation	0.25	0.43	204,448
Building	0.18	0.39	204,448
Ever Annexed	0.39	0.49	204,448
Grad with 4yr Degree in 4 years	0.08	0.27	204,448
Grad with 4yr Degree in 6 Years	0.21	0.41	204,448
Grad with 4yr Degree in 8 years	0.25	0.43	204,448
Grad with CC Degree in 2 Years	0.01	0.11	204,448
Grad with CC Degree in 4 Years	0.04	0.20	204,448
Asian	0.04	0.20	204,448
Black	0.11	0.31	204,448
Hispanic	0.19	0.39	204,448
White	0.65	0.48	204,448
Male	0.51	0.50	204,448
Economically Disadvantaged	0.15	0.36	204,448
Limited English Proficieny	0.01	0.11	204,448
Sticker Tuition	1269.73	0.39	204,448
Grants	214.20	940.36	119,693

Note: This table is constructed using ERC and Texas Association of Community College data and includes students from 1994-2005 who live K-12 Districts that are part of community college taxing districts that experience any annexation from 1994-2005. This includes Austin Community College, Amarillo Community College, Hill Community College, and Lone Star Community College. Grants are calculated using a sample with different years (from 2001-2005).

TABLE 3—SUMMARY STATISTICS, BEFORE AND AFTER ANNEXATION

	Pre			Post		
	Mean	SE	N	Mean	SE	N
Enrolled in CC, Fall	0.23	0.42	29,033	0.28	0.45	51,679
Enroled in 4yr, Fall	0.28	0.45	29,033	0.28	0.45	51,679
Enrolled In-District, Fall	0.14	0.35	29,033	0.21	0.40	51,679
Sticker Tuition	1993.98	0.46	29,033	1160.06	0.14	51,679
Pays In District Tuition	0.11	0.31	6,663	0.72	0.45	14,390
No Public Enroll, Fall	0.49	0.50	29,033	0.45	0.50	51,679
Grad w/ 4yr Deg. in 4 yrs	0.07	0.26	29,033	0.09	0.29	51,679
Grad w/ 4yr Deg. in 6 yrs	0.23	0.42	29,033	0.25	0.43	51,679
Grad w/ 4yr Deg. in 8 yrs	0.27	0.44	29,033	0.29	0.45	51,679
Grad w/ CC Deg. in 2 yrs	0.01	0.08	29,033	0.01	0.11	51,679
Grad w/ CC Deg. in 4 yrs	0.02	0.15	29,033	0.05	0.22	51,679

Note: This table is constructed using ERC and Texas Association of Community College data and includes students from 1994-2005 living in K-12 districts that experienced annexation. The data are split before and after annexation. This includes Austin Community College, Amarillo Community College, Hill Community College, and Lone Star Community College.

TABLE 4—CHANGES IN PRICE

	CC Tuition	In Disitrict	Grants	Grants, No Zero
Annexation	-1.140***	0.55***	-172.2	-282.9***
SE	(0.053)	(0.022)	(125.9)	(83.1)
Mean of Dep Var	1.270	0.71	322.7	3595.8
N	204,448	54,624	273,594	24,553
Year and District FE	X	X	X	X
Demographics	X	X	X	X
College/Year FE	X	X	X	X

Note: This table considers the changes in cost associated with annexation. CC tuition is the amount paid in tuition for two, 12 credit hour semesters in $1000s of 2012 dollars. In District is an indicator for whether a student pays in district tuition among community college attendees. For both tuition and in-district status, high school graduates from 1994-2005 are considered. Grants consider the amount of grants received at community colleges for high school graduates from 2001-2012. The rows at the bottom indicate inclusion of controls for year and district fixed effects, demographic characteristics including race and gender, and college by year fixed effects. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1,^{**}p < .05,^{***}p < .01$.

TABLE 5—STUDENT CHARACTERISTICS

	Linear Prediction	Asian	Black	Hispanic	White
Annexation	0.0022	0.0029	-0.0057	-0.010	0.013
	(0.0021)	(0.0032)	(0.012)	(0.015)	(0.020)
Year, Dist FE	X	X	X	X	X
College/Year FE	X	X	X	X	X
Mean of Dep Var	0.26	0.044	0.11	0.19	0.65
N	204,448	204,448	204,448	204,448	204,448

	Male	Econ. Dis.	Limited English	No College Plans	Grad HS
Annexation	-0.0024	-0.036	-0.0031	0.041*	-0.00816
	(0.0043)	(0.027)	(0.0023)	(0.022)	(0.0141)
Year, Dist FE	X	X	X	X	X
College/Year FE	X	X	X	X	X
Mean of Dep Var	0.51	0.15	0.012	0.23	0.708
N	204,448	204,448	204,448	204,448	229,519

Note: This table considers how student characteristics vary with annexation. All estimates use high school graduates from 1994-2005. "Grad HS" is estimated for cohorts that will be annexed in the future by examining 10th graders from the 1996-2005 graduating classes. The columns at the bottom indicate inclusion of controls for year and district fixed effects, demographic characteristics including race and gender, college by year fixed effects, and an indicators for new campuses. Standard errors are clustered at the K-12 district level are in parentheses with $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$.

TABLE 6—IMMEDIATE ENROLLMENT EFFECTS

	1	2	3	4	Per $1000	Elasticity
A. Enroll CC	0.035***	0.034***	0.033***	0.032***	-0.028***	-0.16***
	(0.0056)	(0.0049)	(0.0050)	(0.0059)	(0.0041)	(0.033)
Mean Dep Var						
0.27						
B. Enr Univ	0.0060	0.0018	0.0035	-0.00045	0.00040	0.00052
	(0.0078)	(0.0084)	(0.0087)	(0.0094)	(0.0039)	(0.032)
Mean Dep Var						
0.25						
C. Enr In Dist	0.044***	0.042***	0.043***	0.044***	-0.038***	-0.35***
	(0.0100)	(0.0097)	(0.0097)	(0.0096)	(0.0038)	(0.063)
Mean Dep Var						
0.21						
D.No Pub. Enr	-0.040***	-0.035***	-0.036***	-0.031***	0.027***	0.096***
	(0.0089)	(0.0080)	(0.0081)	(0.0086)	(0.0046)	(0.020)
Mean Dep Var						
0.49						
Year, District FE	X	X	X	X	X	X
Demographics		X	X	X	X	X
College Trends			X			
College/Year FE				X	X	X
N	204,448	204,448	204,448	204,448	204,448	372

Note: Each estimate in columns 1-4 represent the coefficient on the annexation indicator variable. Column 1 only contains Year and District Fixed Effects. Column 2 contains demographic indicators such as indicators for gender, race, and economic disadvantage. Column 3 adds linear college time trends. Column 4 adds college district by year fixed effects. Column 5 presents the estimate from 3 where tuition changes are instrumented for using the annexation indicator. Column 6 presents estimates of the elasticity where the data is collapse to K-12 school district-year cells. A weighted regression is then run looking at log enrollment and log tuition. All results use high school graduates from 1994-2005. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1,^{**} p < .05,^{***} p < .01$.

TABLE 7—LONGER TERM ENROLLMENT

A. Enr CC	1 year	2 years	3 years	4 years	5 years	6 years
Annexation	0.036***	0.027***	0.024***	0.0095*	0.0083*	0.014***
	(0.0098)	(0.0061)	(0.0061)	(0.0051)	(0.0044)	(0.0036)
Mean of Dep Var	0.39	0.25	0.18	0.14	0.11	0.089
N	204,448	204,448	204,448	204,448	204,448	204,448
A. Enr Univ	1 year	2 years	3 years	4 years	5 years	6 years
Annexation	0.010	0.0082	0.0089	0.017**	0.0068*	0.0082***
	(0.0062)	(0.0076)	(0.0079)	(0.0065)	(0.0038)	(0.0027)
Mean of Dep Var	0.23	0.25	0.25	0.20	0.13	0.089
N	204,448	204,448	204,448	204,448	204,448	204,448
Year, District FE	X	X	X	X	X	X
Demographics	X	X	X	X	X	X
College/Year FE	X	X	X	X	X	X
Yrs Since Annex	X	X	X	X	X	X

Note: This row explores enrollment for a student beyond the first fall after high school. Each column explores if a student was enrolled in X^{th} year after high school graduation. The rows at the bottom indicate inclusion of controls for year and district fixed effects, demographic characteristics including race and gender, college by year fixed effects, indicators for new campuses, and indicators for years since annexation. All results use high school graduates from 1994-2005. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1,^{**}p < .05,^{***}p < .01$.

TABLE 8—COMMUNITY COLLEGE EFFECT ON EDUCATIONAL ATTAINMENT

	Grad CC in 2yrs	Grad CC in 4yrs
A. Reduced Form		
Annexation	-0.0024	0.00316
	(0.0015)	(0.00288)
B. IV		
Attend CC	-0.052*	0.070
	(0.029)	(0.065)
C. Cross Section		
Attend CC	0.023***	0.075***
	(0.0033)	(0.0079)
Mean of Dep Var	0.011	0.041
N	204,448	204,448
Year and District FE	X	X
Demographics	X	X
College/Year FE	X	X

Note: This table considers the effect of community college attendance on educational attainment from 1994-2005. Panel A considers the reduced form effect of annexation on graduation outcomes and Panel B instruments for community college attendance within the first year after high school graduation using an indicator for annexation. Panel C performs the same analysis using OLS on the same data. The rows at the bottom indicate inclusion of controls for year and district fixed effects, new campuses, demographic characteristics including race and gender, and college by year fixed effects. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1$,** $p < .05$,*** $p < .01$.

TABLE 9—TRANSFER

	(1) Year 2	(2) Year 3	(3) Year 4	(4) Year 5	(5) Year 6
Annexation	0.011	0.014*	0.015**	0.0072***	0.0084***
	(0.0067)	(0.0074)	(0.0056)	(0.0021)	(0.0019)
Year and District FE	X	X	X	X	X
Demographics	X	X	X	X	X
College/Year FE	X	X	X	X	X
Mean of Dep Var	0.13	0.17	0.15	0.098	0.072
N	204,448	204,448	204,448	204,448	204448

Note: This table considers student transfer behavior. Transfer is defined as attending a university in the X^{th} year when having attended a community college in a prior year. The rows at the bottom indicate inclusion of controls for year and district fixed effects, demographic characteristics including race and gender, college by year fixed effects, and indicators for new campuses. All results use high school graduates from 1994-2005. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1,^{**}p < .05,^{***}p < .01$.

TABLE 10—HETEROGENEITY

	Enroll CC	Enroll 4yr	No Public Enroll	Grad CC in 4yrs
A. Econ. Dis.				
Annexation	0.030***	0.0069	-0.037***	0.0025
	(0.0074)	(0.010)	(0.0098)	(0.0030)
Annex*Econ Dis.	0.022	-0.038*	0.016	0.00025
	(0.026)	(0.021)	(0.021)	(0.010)
B. Race				
Annexation	0.027***	0.013	-0.039***	0.00043
	(0.0066)	(0.010)	(0.011)	(0.0032)
Annex*Black	0.021**	-0.047***	0.026**	0.0083*
	(0.0094)	(0.0076)	(0.010)	(0.0042)
Annex*Hispanic	0.014	-0.021	0.0051	0.0050
	(0.018)	(0.013)	(0.014)	(0.0056)
C. Gender				
Annexation	0.027***	0.0049	-0.032***	-0.00067
	(0.0087)	(0.010)	(0.0074)	(0.0030)
Annex*Male	0.0092	-0.010	0.0016	0.0076***
	(0.0092)	(0.0085)	(0.012)	(0.0025)
Year, District FE	X	X	X	X
College/Year FE	X	X	X	X
Mean of Dep Var	0.27	0.25	0.49	0.041
N	204,448	204,448	204,448	204,448

Note: This table considers the effect of annexation separately by different student characteristics. Each column represents a new outcome. Panel A contains results that fully interact the model with indicators fully for economic disadvantage. Panel B contains results that fully interact the model with indicators fully for race. Panel C contains results that fully interact the model with indicators for gender. The rows at the bottom indicate inclusion of controls for year and district fixed effects, an indicator for new campuses, and college by year fixed effects. All results use high school graduates from 1994-2005. Standard errors are clustered at the K-12 district level and are in parentheses with $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$.