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Public Higher Education Costs and College Enrollment

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How have changes in the costs of enrolling for full-time study at public 2-year and 4-year colleges have affected the decisions about whether and where to enroll in college? We exploit local differences in the growth of tuition at community colleges and public 4-year colleges to study the impact of public higher education costs on the postsecondary enrollment decisions of high school graduates over three decades. We model prospective students' decisions about whether to attend community college, a public 4-year university in their state of residence, other colleges, or no college at all as relative costs change. Unlike institutional analyses, our contribution is not to model how enrollment changes at a particular college or type of college as costs change. But, we draw from the institutional literature to help identify enrollment impacts by instrumenting college costs using policy variation imposed by state appropriations and tuition caps. We estimate that in counties where local community college tuition doubled (about average for the study period), the likelihood of post-secondary enrollment fell by about 0.06, on a mean of about 0.80. In addition to reducing college enrollment overall, rising costs at community colleges diverted other students to 4-year colleges. Rising relative costs of 4-year public colleges similarly diverted some students toward community colleges, but did not limit college attendance in the aggregate. We also find evidence of endogeneity in cost setting at the institution level. Our preferred estimates rely on a control function approach that instruments intertemporal changes in institutional costs using state and local appropriations and state policies to restrict tuition growth.

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1 Introduction

Understanding the relationship between the costs of higher education and student enrollment has been a central problem in the economics of higher education for decades. Early work on the topic often relied on time-series analyses of single institutions. With better data, more variation in tuition, and the implementation of numerous policy efforts to rein in costs, recent empirical research has improved our understanding of the impact of tuition increases on enrollment at universities and colleges and provided better and clearer insight into the elasticities of demand for higher education. This is a question of obvious importance to public institutions of higher education.

However, a different consideration is equally important for politicians and state policy makers who provide funding and oversight to public colleges and universities. For them, the post-secondary enrollment options and decisions of their constituents are of fundamental and primary interest. How students (and by proxy their parents) fare when faced with the changing costs of enrollment at the various public colleges and universities in their states directly affects voters' support for higher education and elected officials. Of course, the college enrollment behavior of young people also affects human capital of the population in a state and has direct consequences for economic development.

Rather than using institution-level data to assess net enrollment effects of tuition changes, we focus on how three cohorts of high school graduates respond to changing real and relative costs of higher education in their states. While these are related questions, the distinction is subtle, but important. Enrollment changes in state colleges in universities subsequent to tuition changes are barometers of how students in the state respond. However, they are imperfect since most colleges enroll some students from out of state. But more important, they provide no insight

into which college or university a given student enrolls. That is, they provide no insight into a treatment margin of direct importance to policy makers: How do costs affect the likelihood of enrolling in a public 4-year college, community college, leaving the state for college, or no college at all.

The relentless increase in the costs of attending college has been a source of concern for students, families, and policy makers for decades. Among students and families, the consequences include daunting decisions about enrollment and soaring levels of debt. For policy makers and analysts, the concern is that rising costs limits access, constrain choice, and reduces persistence. Because of its salience and potentially worrisome effects, the rising cost of public postsecondary education has spurred a variety of policies at the state and local levels. These include local promise programs and state policies to provide merit scholarships to in-state students who attend public flagships. They also include smaller need-based programs. Indeed, in a recent review of all states' higher education authorities' websites, we identified 155 need-based policies implemented across all 50 states in the past quarter century to reduce the costs of attending public 4-year or local community colleges.[1]

At the federal level, the response has mainly been to provide information about the costs of attending colleges. Evidence about the role of cost in limiting access to college and reducing persistence is long-standing and well established (e.g., Leslie and Brinkman, 1987; Heller, 1997). There is also good evidence that lowering costs via financial aid increases attendance and persistence even if these tools do not always work as directly and clearly as expected (Dynarski and Scott-Clayton, 2013).

[1] Data on these programs will be made available via an online appendix.

The unremitting rise in the costs of higher education and the varied policies state and local governments have implemented in response is the context for this paper. We evaluate how changes in the costs of enrolling for full-time study at public 2-year and 4-year colleges have affected the decisions about whether and where to enroll in college. To do so, we examine the postsecondary enrollment decisions made by high school graduates during the past three decades – comparing students in states that see different rates of growth in relative tuition at their local 2-year and 4-year colleges.

In this paper, we update the literature on the relationship between the costs of public higher education and college enrollment decisions. As we describe below, evidence at the national level on this question relies on data that are now more than 15 years old. For example, Hemelt and Marcotte (2016) used student-level data from high school graduates in 1992 and 2004 to estimate student enrollment in response to changing tuition costs. More recent evidence comes from analyses in select states, relying on local policy changes for identification. In this paper, we broaden the focus to the nation, enabling us to make use of variation in the real costs of higher education in different states to identify impacts on college enrollment.

To compare the enrollment decisions of recently graduated high school students we harmonize data from three nationally representative National Center for Education Statistics (NCES) surveys: The High School Longitudinal Survey (HSLS); the Education Longitudinal Survey (ELS); and the National Education Longitudinal Study (NELS). We use these data to create pooled cross-sections of students who graduate high school in 1992, 2004, and 2013. Each of these surveys provides detailed data on student attributes and achievement while in high school, as well as information about college enrollment collected during follow up interviews two and eight years after high school graduation. Our restricted-use data also identify the state

and county where sample respondents lived when they graduated from high school. So, we can measure the cost of full-time enrollment at the public 4-year colleges and local 2-year community colleges that students in each of these cohorts confront as they decide whether or where to enroll after graduating from high school. As we illustrate, students in different states in these cohorts confront different patterns of tuition growth over the 1990s, 2000s, and 2010s. We use differences in the changing costs of higher education within states as leverage to identify the impact on enrollment. Further, we exploit state and local policies to constrain tuition growth or affect the revenue of state colleges and universities to implement a control function estimate of the impacts of real tuition changes within states on the enrollment decisions of individual students.

We estimate that for high school graduates in counties where community college tuition doubled (the average over the study period), the likelihood of enrolling in any form of post-secondary education fell by about 0.06, on a mean of about 0.80. Community colleges serve students who might otherwise not attend college, and rising costs at these institutions reduced college going on net. We also find that relative increases in community college costs led to a substitution toward public 4-year colleges.[2] Similarly, we find that increasing costs at 4-year schools divert recent high school graduates to community colleges. But we see no evidence that growing tuition costs at public 4-year limits college attendance in the aggregate. Finally, we find evidence of endogeneity in cost setting at the institution level. So, our preferred estimates rely on a control function approach that uses state and local appropriations and state policies to cap tuition growth to instrument for intertemporal changes in institutional costs.

[2] These are the democratization and diversion margins described in the community college literature (e.g. Mountjoy, 2019).

2 Background

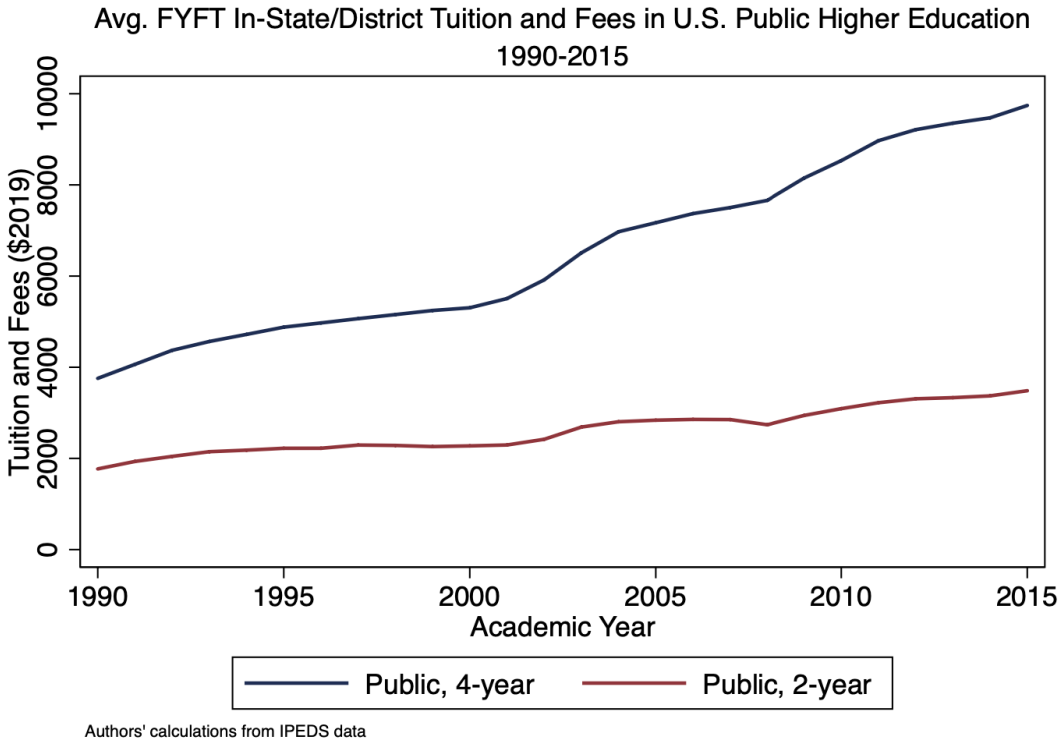
2.1 Tuition Trends

It is well established that the costs of public higher education have been rising, by a lot.[3] This trend has raised concern about a whether there is an education "bubble" (Reilly, 2011 and Thompson, 2017) and the levels of debt being carried by some college graduates (Scott-Clayton, 2018). The trends in college costs that have given rise to these concerns are made clear in Figure 1, which displays enrollment-weighted average real cost of full-year, full-time college tuition for in-district/state undergraduate students at public 2-year and 4-year colleges at over time from 1990 to 2015.[4]

For public 4-year schools, average in-state tuition increased from $3,756 to $9,742 (in 2019 dollars), while the in-district tuition of public 2-year schools increased from $1,770 to $3,484. So, over this period tuition at 4-year schools increased by nearly 160%, and nearly doubled at 4-year schools. At public 4-year schools, the increases in costs were somewhat steady increases from 1990 to the early 2000s, where steeper increases begin to occur at 4-year institutions. While the rate of growth in attendance costs was steady at 2-year colleges, 4-year instutions saw more rapid growth after 2000. While not included in the figure, the tuition at 4-year, private not-for-profit schools nearly doubled as well, and in levels remain nearly three to four times higher than those of public 4-year colleges[5].

[3] For recent trends in costs, see College Board (2019).
[4] We use the terms community college and public 2-year colleges interchangeably.
[5] Tuition and fees at a private not-for-profit in 1990 equal $18,101 and $36,655 in 2015.

Figure 1



2.2 Policy Background

In response to the unrelenting increase in tuition costs, the federal government and state and local governments across the nation have implemented a variety of policies to help students attend college. The federal government funds higher education primarily through awarding financial aid to individual students and research grants. The Higher Education Act of 1965 was last reauthorized in 2008, provides financial assistance to students primarily in the form of Pell grants, and requires post-secondary institutions that receive federal funds to be more transparent in reporting costs of enrollment through a "net price calculator." While not passed, federal efforts exist to establish programs that provide two years of free schooling at Community Colleges, including America's College Promise, a program initially proposed by the Obama Administration and reintroduced in 2019.

At the state level, policies to control the growing costs of public higher education have been common. Public universities have historically relied on state appropriations for funding. Revenue from appropriation reached its peak in 2007-2008 at the national level, and has since declined. While these revenues have increased somewhat since 2012-2013, they still remain below peak levels. To control resulting increases in tuition to offset this declining source of revenue, eleven states have implemented some form of cap or freeze for tuition growth in the 4-year public sector, and ten states have the same for the 2-year public sector. These policies restrict institutions from increasing tuition and fees for students. For example, recession, in 2006 Ohio imposed a cap of 6% on the annual growth of tuition in public 4-year colleges. Similarly, North Dakota implemented capped tuition increases at 4%. Minnesota went further, freezing tuition in 2012 and then mandating a 1% tuition reduction in 2016, while the University of Wisconsin System implemented a tuition freeze in 2014.

Within states, a variety of programs have been implemented to cover full or partial tuition costs to high school graduates to attend local 2- or 4-year schools. Best know are place-based promise programs that provide tuition-free enrollment for students at select colleges. These began with the Kalamazoo Promise in 2005 and there are now over 200 promise programs in 41 states. Some promise programs are state-wide such as TnAchieves, which is available in 90 of the 95 counties in Tennessee. TnAchieves is a last-dollar program covering tuition and fees, working with 13 community colleges, several 4-year schools, and 27 colleges of applied technology. In states like California and Michigan, promise programs are at the local level where students in "promise" areas can go to their local school for free or reduced prices. For example, in California the Long Beach College Promise (implemented in 2008) provides two years of school for free at Long Beach Community College. In addition to Kalamazoo Promise, Michigan

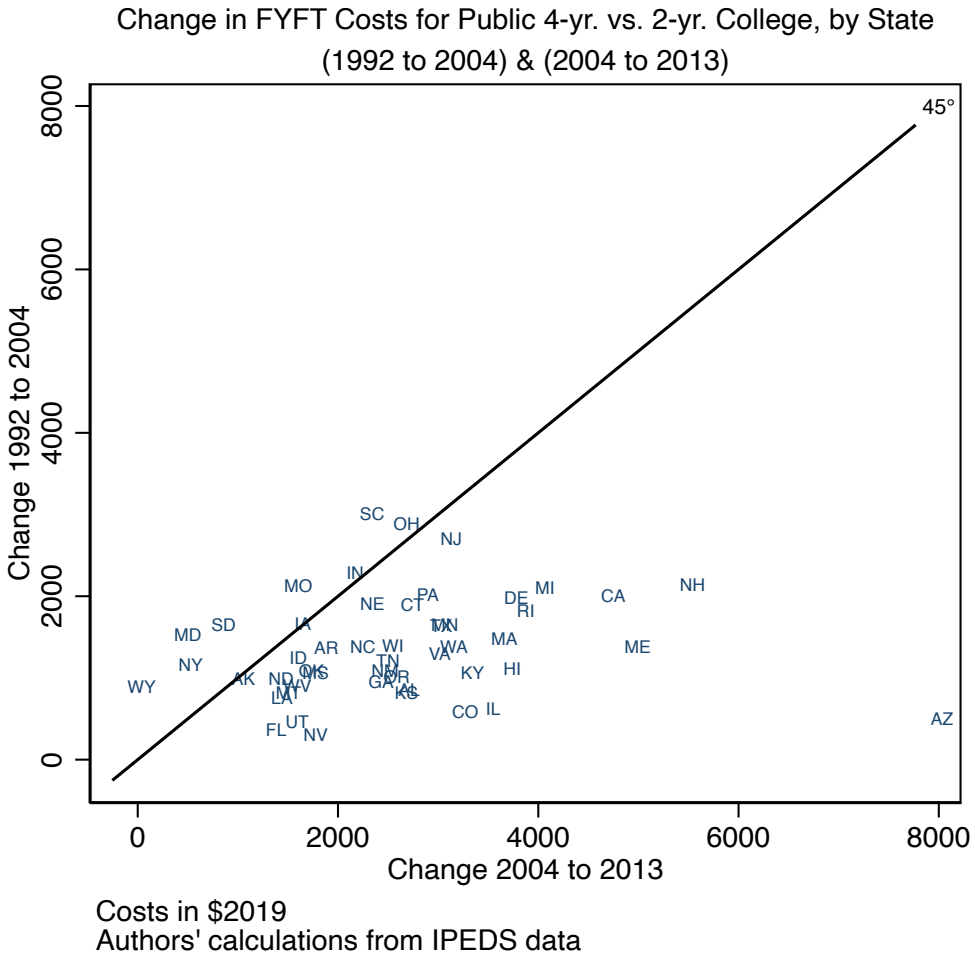
implemented Promise Zones, which focuses on associate degree attainment, where aid is dependent on each zone. Other programs include Michigan's Legacy Scholars, providing tuition-free enrollment and book stipends for two years at Kellogg Community College. These tuition-focused programs lower the cost of attending college in-state, specifically a community college, potentially impacting a student's decision to enroll in community college at a lower cost (or for free) rather than a 4-year, private, or out-of-state school.

This varied policy landscape helped shape substantially different rates of growth across the nation in the relative costs of attending public 4-year colleges and community colleges over the past several decades. To illustrate how relative costs have changed at different rates in different states, in Figure 2 we plot the growth of average cost of tuition and fees for FYFT enrollment at 4-year versus 2-year public colleges by state, between 1992 and 2004 (y-axis) and 2004 and 2013 (x-axis). These years represent three different decades and align with the high school graduation years of the cohorts we study below. Each point in the scatterplot illustrates the difference between the growth of public 4-year and 2-year tuition in each period. We also include a 45° line for reference. If the costs of 4-year colleges increased more by $1,000 than the increase at 2-year schools in a state during both decades, the state would be plotted at the corresponding point on the 45° line.

The scatterplot illustrates two key points. First, cost of 4-year colleges attendance became relatively more expensive in most states between 2004 to 2013. Second, the relative costs of attending 4-year vs. 2-year colleges changed differently across states during these decades. For example, the costs of attending a 4-year school increased by nearly $2,000 relative to community colleges between 1992 and 2004 in Maryland and New York. Yet, the relative costs of attending 4-year vs. 2- year colleges hardly changed in the next decade in these states.

On the other hand, in Arizona, the cost of tuition at a 4-year school increases dramatically relative to community colleges between 2004 and 2013, after a decade of nearly equal growth. Other large states like California and Illinois also saw sizeable increases in the costs of attending 4-year colleges relative to 2-year colleges between 2004 to 2013. We exploit this variation in relative costs of 2- and 4-year colleges across states and decades in our empirical models, below.

Figure 2



2.3 Literature Review

The earliest and most substantial strand of literature on enrollment responses to changes in tuition and fees relies on institution level data. Early studies often used data on cost changes and enrollment at one or a small number of colleges or universities, with obvious limitations for establishing counterfactuals. Jackson and Weatherby (1975) review early empirical studies of enrollment responses to price changes at various institutions (7 studies) and reported that institutional enrollment fell by between 6 to 19 percentage points each $1,000 increase in cost for full-time study. Later, in 1987 Leslie and Brinkman reviewed the growing literature (25 studies), concluding that a tuition increase of $1,000 is associated with a decrease in enrollments by 6 to 8 percentage points. Heller (1999) updated this review and reported similar estimates of tuition elasticity of enrollment.

More recent and compelling work uses institution-level data over time from the national panel data from the Integrated Postsecondary Education Data System (IPEDS) collected by the National Center for Education Statistics. Kane (1995) used these data and estimated that a $1,000 increase in tuition at public 2-year schools was associated with a decrease in public undergraduate enrollment within a state by 3.5 percentage points. Long (2004) found that in 1972 students were 15% less likely to attend any college for each additional $1,000 in cost, while those in 1982 were 11% less likely to attend in response to the same cost increase. This represents a decrease in elasticity of demand from 0.34 to 0.233. Later papers estimated even smaller price response.[6] Shin & Milton (2006) found no significant impacts of tuition change on enrollment in their sample of more than 400 institutions. Hemelt & Marcotte (2011) estimated

[6] It is not clear whether the decline in the elasticity of enrollment in over time is an artifact of sample or research design, or due to changes in demand for higher education in response to the rising earning premium for a college degree over the period.

the impact of tuition increases on enrollment and credit hours, differentiating by institution type. They found that a $1000 increase in tuition is associated with a 2.5 percent decrease in enrollment, noting that effects are larger at Research I and top 120 public universities.

Studies using institution level panel data rely on the identifying assumption that intertemporal changes in tuition are independent of other changes at institutions that may affect enrollment demand. Deming and Walters (2020) expanded on this by distinguishing between tuition-price setting that is constrained by state-level appropriations and legislatively mandated tuition caps - separate from institution-level discretionary decisions about tuition levels. Because the latter may reflect institutional choices related to investments in instruction or student services, they may be related to other changes at the institution that affect student demand. Deming and Walters attempted to circumvent this endogeneity concern by instrumenting tuition costs in an institution-level panel framework using state appropriations and tuition caps. They found small or insignificant effects of tuition increases on enrollment.

A different strand of literature uses student level data within states, examining the impact of costs on enrollment decisions and using natural experiments induced by state or sub-state policies that reduce the cost of enrollment for some students and not others. Dynarski (2003) analyzed the impact of eliminating the Social Security Student Benefit Program in 1982 on college enrollment, finding that $1,000 in grant aid increases college attendance by 3.6 percentage points. A number of authors have exploited the introduction of state merit aid programs that reduce costs of attending select public universities or colleges for eligible in-state students. For example, Dynarski (2000) studied the impact of receiving aid through the Georgia Hope Scholarship on college attendance on middle and higher-income students. She found that the HOPE program increased the attendance of high school graduates by 7 to 7.9 percentage

points, concluding that for every $1,000 in aid, the state attendance rate increases by 3.7 to 4.2 percentage points. Cornwell et al. (2006) studied the Georgia HOPE program as well, but for all students, and found that the merit scholarship increased enrollment by 5.9%. Bruce and Carruthers (2014) use data of Tennessee public high school students, they explore the effects of the Tennessee HOPE Scholarship on college-going, college level, whether they attended college in-state or out-of-state, and the sector of enrollment. They found little evidence merit aid induced college going, or staying in-state but found reduced college cost result in substitution toward enrollment at 4-year colleges over 2-year colleges.

Natural experiments focusing on the cost of community college attendance include the work of Carruthers and Fox (2016), who assessed the effects of a merit scholarship program for attending community college in Knox County Tennessee. They found this merit aid program resulted in large increases in community college enrollment. This suggests that aid targeted at community colleges may increase postsecondary enrollment at the extensive margin. Similarly, Denning (2019) examined the impact of community college tuition on college enrollment in Texas. In response to expanding tuition discounts for in-district students, Denning finds that a $1,000 reduction in tuition increased community college enrollment by 5.1 percentage points (an elasticity of -0.29).

Finally, a third strand of literature uses student level data at the national level, exploiting variation across time and/or states in the rate of growth of tuition costs to identify effects on college attendance. An early paper of this type is Manski and Wise (1983), who used data from the National Longitudinal Study (class of 1972) to study the impact of financial aid awards under the Basic Educational Opportunity Grant (later renamed the Pell Grant) on enrollment. They found grant aid prompted very low income students to enroll in college, but less evidence of

effects for higher-income families. Hemelt and Marcotte (2016) exploited changes in tuition and fees charged at public colleges during the 1990s and early 2000s to study impacts on enrollment behavior of students from the NELS and ELS survey data. They estimated that increases in the cost of enrollment at 2-year colleges had relatively large negative effects on enrollment – with a $1,000 increase in tuition costs associated with a decrease in the likelihood of enrolling in a community college by 9 percentage points for students. This was nearly twice as large as the enrollment response to a similar price increase at public 4-year institutions.

In this paper, we contribute to this third strand of literature, but draw on lessons from institution-level analyses, too. We use student level data to model how changes in the relative costs of college affect student enrollment choices, estimating models of the decision graduating high school seniors make about whether and/or where to attend college when faced with different relative prices. Hence, unlike institutional analyses, our contribution is not to model how enrollment changes at a particular college or type of college as costs change. Rather, we examine how students in a particular state decide whether to attend community college, a public 4-year university in their state of residence, other colleges, or no college at all as relative costs change. But, we draw from the institutional literature to help identify enrollment impacts by instrumenting college costs using policy variation imposed by state appropriations and tuition caps. We discuss our models and empirical strategy, next.

3 Model and Data

3.1 Model

As a conceptual orientation, consider a simple model of the choice confronting a student finishing high school. Her aim is to maximize lifetime utility by choosing whether to enroll in one of the c different college options available:

(1) $$U_{ic} = f(Y(c), T(c), A(c))$$

Where Y is the expected lifetime income student i would earn if attending college type c, and T is the cost of attendance. A is vector of a variety of other attributes associated with attending college type c. A could include the amenities associated with college c that might enhance the college experience, such as big-time athletics, a beautiful campus, nice dorms, etc. (e.g., see Jacob et al. (2015). A could also include the social value of attending college c, not priced into economic returns. For instance, some colleges might improve social standing – for example attending an Ivy League school may provide some social value beyond direct economic opportunity. Or, A could include distance from home, which might enhance or detract from its value to the student. We simplify the decision confronting the student by reducing the choice set to:

$$c = \begin{cases} No\ college\ enrollment \\ Enroll\ in\ local\ public\ Comm.College \\ Enroll\ in\ public\ 4-yr.college\ in\ state \\ Enroll\ in\ 4-yr\ out\ of\ state\ or\ private \end{cases}$$

With a completely separable utility function, a prospective student assesses expected utility for each of the four options in her choice set as:

(2) $$E(U|c) = E(Y|c) + E(T|c) + E(A|c)$$

Since U_Y' and U_A' are positive, and U_T' is negative, her optimization problem requires choosing the post-secondary enrollment choice that maximizes anticipated lifetime earnings and consumption amenities net of any tuition costs. Observed enrollment outcomes reflect individual assessments of subsequent lifetime income effects and consumption values in comparison to relative costs. In a discrete choice framework, we estimate the impact on enrollment choice as a function of the relative cost of enrolling in college type c. To estimate the ways in which these costs affect this choice, we parameterize the decision as:

(3) $$E_{ic} = \beta X_{ic} + \delta_2 Ln(2yr)_{ic} + \delta_4 Ln(4yr)_{ic} + \delta_p Ln(Priv)_{ic} + \epsilon_{ic}$$

Where E_{ic} is the observed post-high school choice that is the realized assessment of the utility stream student *i* anticipates from among the *c* options; $X_{it}$is a vector of student characteristics (such as demographics and high school achievement) and college attributes that might affect future earnings or college consumption value, and; the costs of enrolling in each of the college options available to student *i* are included in log form. Hence the δ parameters are estimates of the own and cross-price elasticities for community college, 4-year college in-state, or in private or out of state college.

Fundamental to our estimation strategy is the fact that the average costs of enrolling in public 2- and 4-year colleges are a function of county and state of residence. So, in our empirical specifications of the parametric model, $ln(2yr)_i$ is the cost of tuition and fees required for enrolling for full-time study in student *i*'s local community college; $ln(4yr)_i$ measures the enrollment-weighted average tuition and fees for full-time enrollment in public 4-year colleges in *i*'s state, and $ln(Priv)_i$ measures the enrollment-weighted average tuition and fees required for enrolling in the private 4-year colleges in *i*'s state.[7]

If equation 2 were estimated with cross-sectional data, estimates of the δ parameters would confound the relative costs of enrolling in a student's local community college and state universities with average differences in institution quality or local labor markets that could affect the consumption value of attendance or earnings after college. We limit this threat to validity by pooling cohorts of high school students over time, and including state fixed effects (μ_s), as in Equation 4. In models such as this, the parameters of interest ($\delta_2, \delta_4, and\ \delta_p$) identify the effect

[7] In our empirical models, we measure tuition and fee costs in logs because they are log-normally distributed and for ease of interpretation. Our results are not sensitive to this choice.

of the real costs of attending public 2-year, 4-year, and private colleges for a student in a given state on enrollment decisions off of comparisons of students in the same state, at different times. Equation 3 also includes year fixed effects (θ_t), controlling for general changes in college enrollment decisions that are not specific to place or residence – such as those driven by macroeconomic conditions.

(4) $$E_{ict} = \beta X_{ict} + \delta_2 Ln(2yr)_{ict} + \delta_4 Ln(4yr)_{ict} + \delta_p Ln(Priv)_{ict} + \theta_t + \sum_s \mu_s + \epsilon_{ict}$$

Using data from pooled cohorts/cross-sections to estimate the impact of college costs on enrollment choices circumvents threats to validity due to fixed attributes of state educational systems (both K-12 and post-secondary) that might affect college going among a state's high school graduates and be correlated with tuition costs. Empirical models of the form of Equation 4 would identify the effects of tuition on college going by comparing students in the same county/state, but who faced different costs of college attendance by virtue of the cohort into which they were born, compared to the enrollment choices of similar students in other states experiencing different rates of relative growth in tuition at public 2- and 4-yr colleges.

As with any differences-in-differences estimates from a model like Equation 4, the principal threats to validity for interpreting the parameters as causal derive from intertemporal changes in institutional characteristics that are related to tuition costs and that themselves affect demand for seats at local public 2- and 4-yr colleges. For example, it would not be a problem if tuition costs in one state rose more than another because subsidies from state appropriations are declining. But, if tuition increases were due to decisions to invest in academic or other campus programs by the average college in that state increased the costs (and presumably quality) of higher education, then we would confound cost with quality changes. Deming and Walters (2020) employ an instrumental variables (IV) strategy to leverage variation in tuition driven by

variation in state appropriations along with legislatively imposed tuition caps to circumvent the potential endogeneity of changes in tuition that affect the cost of attendance but may also be related to institutional level decisions that themselves may affect demand. The idea here is to distinguish between tuition changes due to central, legislative decision and decisions made by college administrators that may reflect time-varying factors related to college demand.

The IV strategy of Deming and Walters is sensible and readily employed using institution-level data. In a discrete choice model using student level data, the standard 2SLS set up is less tractable. Nonetheless, it is tuition at the institution-level that shapes individual students' college choices. So, we employ an estimation strategy to distinguish between plausibly exogenous tuition changes that are outside of the control of a student's local community college and in-state 4-year colleges from those are in shaped by institutional strategy and choices and thereby endogenous to student demand. Using institution level data, we estimate tuition and fee costs at all public 2- and 4-year colleges as a function of the instruments proposed by Deming and Walters (2020).[8] Then we use those results to set up a control function estimate of tuition costs on individual student decisions. First, we estimate Equations (5) and (6) using institution-level data. These estimate tuition costs at public 2- and 4- year colleges as a function of institutional attributes, time and institution fixed effects, appropriations from the state (and local governments for community colleges), as well as constraints on tuition imposed by state legislation. The residuals in these equations provide information about an institution's own choices on tuition setting, over and above what is expected. We then use the enrollment-weighted mean residuals of the public 2- and 4-year colleges in a student's county and state as a control function to augment the differences-in-differences specification of Equation 4.

[8] We obtain data on tuition caps for 2- and 4-year colleges directly from Deming and Walters (2020).

(5) $$Ln(2yr)_{it} = \pi_0 + \pi_1 App2yr_{it} + \pi_2 Cap2yr_{it} + \pi_3 X_{it} + \theta_t + \sum_s \mu_s + \nu_{2it}$$

(6) $$Ln(4yr)_{it} = \pi_0 + \pi_1 App4yr_{it} + \pi_2 Cap4yr_{st} + \pi_3 X_{it} + \theta_t + \sum_s \mu_s + \nu_{4it}$$

(7)

$$E_{ict} = \beta X_{ict} + \delta_2 Ln(2yr)_{it} + \delta_4 Ln(4yr)_{it} + \delta_p Ln(Priv)_{it} + \theta_t + \sum_s \mu_s + \eta_2 \hat{v}_{2st} + \eta_4 \hat{v}_{4st} + \epsilon_{ict}$$

Equation 7 includes control functions for the institutional determinants of 2-year college tuition in a student's county ($\hat{v}_{2st}$) and 4-year college tuition in a student's state ($\hat{v}_{4st}$). The coefficients on these control functions are of interest for two reasons. First, they provide a direct (Hausman) test of the endogeneity of institutional price setting on student enrollment decisions. Second, the control function coefficients provide insight into any unmeasured attributes of colleges that coincide with tuition changes that affect students' decisions. If the control functions on tuition at a student's local 2-year (or 4-year) institution is positive (negative), this is evidence that students perceive schools that see relatively large tuition increases as those that are offering better (worse) services, quality or student experience, too.

As with Equation 4, an empirical implementation of Equation 7 yields estimates of the impacts of the average difference in college attendance for a student, relative to a comparable student from the same state in a different cohort who faced different costs of attending a 2-year college – holding constant the costs of attending a 4-year school in the state. However, Equation 7 controls directly for enrollment changes due to tuition changes due to institutional discretion – and so provides a more credible causal estimate of the enrollment effects of tuition costs, per se.

Using this specification, we estimate a series of multinomial logit models to estimate the relative costs of enrollment at 2-year versus 4-year public colleges and universities on where a student enrolls, faced with multiple options as well as not enrolling at all. Again, the variation

driving the estimates will come from differences between cohorts in the cost of attending a 2-year versus public 4-year college within states.

3.2 Data

To examine the effect of changing costs on post-secondary enrollment, we use data from several sources from the National Center for Education Statistics. We use student-level data cohort surveys of students followed for up to eight years after high school from The National Education Longitudinal Study (NELS), the Education Longitudinal Study (ELS), and the High School Longitudinal Study (HSLS). These surveys allow us to examine changes in post-secondary enrollment decisions for nationally representative samples of students in three different periods, NELS (1988-2000), ELS (2002-2012), and HSLS (2009-2017). We merge data on tuition costs in the states and counties and counties where students finish high school, using data from the Integrated Postsecondary Education Data System (IPEDS). To match IPEDS data to the student-level data, we draw upon location information of schools (state and county) available in the Common Core of Data and the Private School Universe Survey.

3.2.1 Student-level Data

The NELS, ELS, and HSLS are nationally representative surveys that begin tracking students between eighth and twelfth grade and then up to eight years post expected high school graduation.[9] Each study includes data from students, parents, teachers, and school administrators. We obtain comparable measures of student demographics, family background, academic ability, and school-level information for each study. These include gender, race and ethnicity, family income, mothers' education attainment, family composition, total enrollment in the respondents' high schools, and standardized math scores.

[9] The NELS first sampled students in 8th grade, while the ELS first collects data in 10th grade, and the HSLS first collects data in 9th grade.

Importantly, we restrict our analyses to students who graduate high school on time (1992, 2004, 2013) and provide a response to the question asking whether or not they enroll in a postsecondary institution by the time of the second follow-up.[10] Because we rely on information about the costs of college enrollment in the community college district and state where a student resides upon high school graduation, we drop 26 students for whom we do not have state information on state of residence. Additionally, because our estimation strategy relies on changes in tuition at the state level between survey cohorts, we restrict our analyses to students in states that were home to some students from each of the NELS, ELS, and HSLS surveys. This excludes students from Washington, D.C. and Hawaii. Our pooled estimation sample includes 9,515 students from the NELS, 11,530 students from the ELS, and 16,556 students from the HSLS. Last, we exclude students that enroll in institutions that offer neither 2-year or 4-year degrees, private-for-profit institutions, and private 2-year institutions. We then generate variables that describe students' first enrollment choice within two years after high school. We define four discrete choices: No post-secondary enrollment; enrolls in an in-state/district public 2-year college; enrolls in a public 4-year school in the graduate's state of residence, or; enrolls in a private 4-year college or a public 4-year institution in a different state.[11]

3.2.2 Institution-level Data

For each student in our pooled NELS/ELS/HSLS data, we merge in data on the tuition and fee costs of enrolling for full-time study in their local community college, the public in-state 4-year colleges, and as well as the private, not-for-profit 4-year colleges in their state.[12] We obtain these

[10] We exclude roughly 19% of students in the NELS, 18% of students in the ELS, and 10% of students in the HSLS who do not graduate high school with their respective cohorts.
[11] We exclude respondents that enroll in a college that does not report sector, level, and state location information to IPEDS.
[12] We match this tuition information to the student-level data using the school location from the NELS, ELS, or HSLS, when available. When this was not available, we match the high school to the Common Core of Data to obtain the state and county of students' high school. For students without county information, we use state averages.

costs from the Integrated Postsecondary Education Data System (IPEDS), collected by NCES on every post-secondary institution (college, university, technical, vocational) that participates in federal student aid programs. IPEDS contains information on enrollment, tuition, completion rates, faculty, staff, and financial aid. For each relevant graduation year (NELS (1992), ELS (2004), and HSLS (2013)), we generate the average cost of tuition and required fees by type of college (e.g., 4-year public) weighted by enrollment, by state. For community colleges, we generate enrollment weighted averages by county of residence. Tuition and fee costs are measured in 2019 dollars, adjusted using the consumer price index.

We collect IPEDS information on state appropriations and local appropriations for community colleges for each reporting institution to generate state averages in each graduation year of our sample (1992, 2004, 2013). We also include data on state legislation that impacts institution costs through tuition caps and freezes (Deming & Walters). We use county unemployment rates in the year students graduate high school using Local Area Unemployment Statistics (LAUS) data by the U.S. Bureau of Labor Statistics. While we include state and year fixed effects in the models, state and county unemployment data allows us to control local labor market conditions that can impact enrollment numbers and opportunity costs (Hemelt & Marcotte, 2011).

4 Results

4.1 Descriptive Statistics

In Table 1, we present descriptive statistics for our pooled NELS, ELS, and HSLS data. Each survey consists of almost equal numbers of men and women. The proportion of respondents who are white non-Hispanic falls across the surveys, from 74 percent for the NELS sample to 55 percent among HSLS respondents. The proportion of the samples that are Black remained around

11 to 12 percent across the surveys, while the proportion who were Hispanic increased from 9 to 21 percent. A majority of students have parents who are married (75-83%). The measures of parents' education in the NELS, ELS, and HSLS make it impossible to consistently distinguish between high school graduates with no college and those with some college. So, we measure parental education using the only categories that are clearly comparable across all three surveys: whether a parent is a high school dropout, or a college graduate. The omitted category includes those who completed high school, whether or not they earned come college credits short of a bachelor's degree. Unsurprisingly, the education level of the parents of students increased over the cohorts: For example, 12 percent of NELS respondents had mothers who did not complete high school, compared to 8 percent of HSLS respondents. The percent of mothers who had completed a college degree rose from 26 to 32% over this period.

In terms of family income, we treat four comparable categorical income groups as continuous variables where we take the midpoint of each income bin and adjust to 2019 dollars. For the highest income categories (i.e., 75,000 or more) we take 1.5 times the lower bound and adjust the sum to 2019 dollars as well. We report median income in Table 1. Median income is highest in the ELS cohort. We report students' standardized score on a math assessment (mean of 50), which is comparable across surveys[13].

Across the survey years, college-going rates are comparable, with the rate of postsecondary enrollment for the graduating high school classes of 1992, 2004, and 2013 of 77, 81 and 83 percent, respectively. The proportions of students enrolling in community college, in-state public 4-year colleges and other colleges are similar for each cohort, with some evidence of a decline in the proportion enrolling in 2-year schools. We calculate the average in-state cost to

[13] Standardized math scores are reported for 12th grade in the NELS and ELS cohorts, and 11th grade for the HSLS.

attend a 4-year public institution and the average in-district cost of attending a community college in 2019 dollars. The average price of in-state tuition and fees more than doubles (117% increase) from $3,602 in the NELS to $7,825 in the HSLS. The cost of in-district tuition and fees increased from $1,973 (NELS) to $3,350 (HSLS), nearly a 70% increase.

4.2 College Enrollment

In Table 2, we present the results of linear probability models of the impact of tuition costs at local 2-year, state 4-year, and private college tuition on the likelihood that members of the NELS, ELS, and HSLS cohorts will enroll college after high school graduation. In columns 1 and 2, we report results of models of college enrollment as a function of the real cost of attending community college, and separately the average public 4-year college and the average private, not-for-profit college in a student's home state and controlling for student characteristics, family income, measures of achievement in high school and the size of a student's high school and cohort fixed effects. In column 1 we omit state fixed effects, while in column 2 we include them, so this is the specification in equation (3). In column 3, we report the result from equation (6), including the control functions for the costs of enrollment in a 2-year or 4-year college in a student's county/state during the year of high school graduation.

The coefficients on demographic characteristics and family background are as expected: Students are more likely to enroll in college if they are female and come from families with more educated parents and higher incomes. Interestingly, non-Hispanic students are marginally less likely to enroll in college than comparable students of other races. This relationship disappears if we omit the control for high school math scores.

The coefficients of interest in Table 2 are those on the costs of full-time attendance at the community colleges in the county where a student attended high school, the enrollment-weighted

costs of attending a public 4-year college in a student's state of residence, and the enrollment-weighted costs of attending a private 4-year college in that state. The differences between the coefficients in columns 1 and 2 illustrate the power of state fixed effect and the importance of cross-cohort comparisons of high school graduates only to peers within the same state. In column 1, we estimate relatively small effects of community college tuition and a positive relationship between private college tuition and college attendance. These results are inconsistent with the established empirical patterns in postsecondary education, such as the democratizing function of community colleges and a downward sloping demand function.

In column 2, we report the results from the fully specified equation 3. Relative to a comparable student from the same state in a different cohort who faced different costs of attending a 2-year college – holding constant the costs of attending a 4-year school in the state, we estimate that in states where community college tuition doubled (i.e. the average over the study period), the likelihood of enrolling in post-secondary education fell by about 0.06. The results from the control function model in column 2 are essentially identical. The mean of the dependent variable is 0.81. We find no significant relationship between changes in the costs of attending public 4-year or private colleges and universities in a high school graduates state of residence and the likelihood of enrolling in any college.

This finding that community colleges are the only post-secondary institutions whose costs affect aggregate post-secondary enrollment is consistent with the democratizing role that community colleges play in higher education – serving students who otherwise would not attend college. Conditional on costs at other institutions, changes in tuition at public 4-year colleges and private colleges do not limit post-secondary attendance in the aggregate. This is consistent with the possibility that students who enroll in these institutions are less price-sensitive than those

enrolling in community college. It is also possible that the relevant marginal student chooses between enrollment at 4-year colleges or community college when faced with higher costs, Whereas the marginal student confronting higher community college-costs choose between enrollment or no college at all.

4.3 Discrete Choice Models

Table 3 provides clearer tests of the impact of college costs on whether and where young high school graduates opt to enroll for postsecondary education. In Table 3 we present results for our multinomial logit models of the impact of tuition changes at local public 2-year, in-state public 4-year, and private tuition on post-secondary enrollment choices. The reference/base outcome is no college enrollment, and the remaining discrete choices are: Enrollment in the local community college; Enrollment in a public 4-year college in the state where the responded graduated from high school, and; Enrollment in a private, not-for-profit college, or a public 4-year college in another state. As before, these models control for survey wave and state fixed effects. So, the coefficients are estimated from changes in the enrollment choices of comparable students graduating in the same states in different cohorts, hence facing different tuition prices. In each case, in the odd-numbered columns we present results from models without control functions for enrollment at respondents' local/state community and public 4-year colleges – and then in the even-numbered columns, we report results from models with the control functions.

While we impose no order/ranking on the discrete choices here, the coefficients on parental income and education are consistent with expected patterns: High school graduates whose mothers had completed college are more likely to attend college than those whose mothers did not complete college, and that relationship strengthens from community college, to public 4-year colleges, to private and out-of-state colleges. We see the same pattern with income,

but a somewhat different pattern for achievement measured in high school. Math achievement in high school significantly increases the likelihood of attending college, with a more modest relationship for community college vs. 4-year college enrollment. But, there is no significant difference for high school math achievement between 4-year college enrollees at in-state publics compared to those in private or out of state colleges.

In columns 1 and 2 of Table 3, we estimate that the likelihood a recent high school graduate enrolls in community college falls substantially with tuition costs at community college. Because we include cohort and state fixed effects in all models, the coefficients on costs here are identified off of comparing changes in enrollment choices over time between observationally equivalent students in a state that experienced relatively large increases in the costs of attending community college, relative to public 4-year colleges in the state. The likelihood a high school graduate enrolls in a public 4-year college increases substantially as community college costs rise. The costs of private colleges have no effect on community college enrollment, suggesting these choices are not common substitutes.

The coefficients on the control functions from the community and 4-year college enrollment models on the college choice are informative. The coefficients on the 2-year college control function in columns 4 and 6 imply that larger-than-expected tuition increases at community colleges lead to substitution away from enrollment at 4-year colleges. This could reflect investments in community college programs and offerings that students value. A similar pattern is apparent for the relationship between public 4-year college costs and enrollment in private or out-of-state colleges. In states where public 4-year college costs are rising above expectations, students are less likely to enroll in private colleges.

To interpret the magnitudes of the coefficients from the estimates in Table 3, using the models including the control functions (columns, 2, 4, and 6) we calculate marginal effects of changes in local community college and in-state public 4-year tuition costs on the likelihood of each of the four possible outcomes, reported in Table 4. The post-secondary enrollment choice that is clearly most effected by relative costs is community college. A 100 percent increase in the cost of community colleges would reduce the likelihood a high school graduate enrolls in a community college by 0.109 – almost half the unconditional mean. A change in real tuition costs of this magnitude between cohorts is not uncommon. Nonetheless, even if tuition costs increased more modestly, the change in enrollment likelihood would be a large in magnitude relative to the mean. Further, increasing community college costs raise the likelihood a high school graduate would forego college altogether by 0.057, and increases the chances of enrolling in a private college.

Changes in the costs of attending the public 4-year colleges within states have smaller effects on enrollment choices. Nonetheless, we estimate that a doubling of the costs of public 4-year college enrollment in the state of residence increases the likelihood a high school graduate enrolls in community college by 0.105. These results are consistent with those from Table 2 – tuition increases at 4-year public schools do not reduce college attendance, but they do affect the college attended.

Finally, we find no evidence that changes in tuition at private colleges or have significant enrollment or substitution effects. This may be due to relative price insensitivity of students for whom private college is an option, increased use of tuition discounting, or the possibility that private schools in one's home state are not the right market/margin on which to assess college choice.

4.4 Heterogeneity Analyses

Next, we assess whether changes in the costs of college have different effects on enrollment decisions of prospective students with different resources and family support. First, we split our samples between respondents from families where real annual income was less than $50,000, and those with family incomes above that threshold. We then re-estimate our multinomial logit models separately for these groups. In the top panel of Table 5, we present the marginal effects for these groups of changes in tuition at community colleges and in-state public 4-year colleges from the models in which we include institutional cost control functions.

For high school graduates from families with incomes below $50,000 we estimate that a 100 percent increase in costs decreases the likelihood a student enrolling in community college by over 0.17 compared to an observationally identical student from the same state in previous years. This is much larger than the average marginal effect for all students reported in Figure 2. Further, rising costs at community colleges substantially increase the likelihood that low-income students forego college altogether. Our estimates suggest that holding other enrollment costs constant a 100 percent increase in community college tuition would increase the probability that a high school graduate from a low-income family would forego college altogether by 0.149. This is large, relative to the mean, since the proportion of graduates from low-income families who do not go to college is 0.35. We estimate no significant effects of tuition costs at public 4-year colleges on enrollment choices for low-income high school graduates.

For those from higher income families, rising costs at community colleges reduce the likelihood of enrolling in community college after high school graduation, by 0.092. This is smaller than the change in enrollment we saw for low-income students. And, we see no evidence that increasing community college costs increase the likelihood that high school graduates from

higher income families forego college altogether. Instead, there is evidence that these students substitute away toward private and out-of-state colleges when community college costs rise.

Next, in Panel B of Table 5, we split our sample of high school graduates into those whose mothers had completed college and those whose mothers had not.[14]Parents' education is an important factor in post-secondary enrollment and persistence, and colleges are often mindful of first-generation status among students. We estimate that changes in community college costs have much larger effects on enrollment decisions for those whose mothers had not completed college. We estimate that a 100 percent increase in community college costs in a state between cohorts reduced the likelihood a new high school graduate would enroll by 0.148 if her mother had not completed college, but by only 0.057 if she had. Children of those without a college education were also more responsive to changes in the costs of 4-year college enrollment. We estimate that a 100 percent increase in the costs of 4-year college enrollment between cohorts led to a decline in the likelihood of attending a public 4-year college in state of 0.10 for this group – and an increase in the likelihood of attending community college by 0.142. Among those whose mother had completed college, we see no effects on enrollment patterns that are statistically significant.

5 Conclusions

In this paper, we contribute to the literature on rising costs and enrollment in higher education. We provide an updated national perspective by comparing enrollment decisions from students who graduate high school in across three decades. Harmonizing survey data from the National Center for Education Statistics' NELS, ELS, and HSLS data sets, we compare the enrollment

[14] As discussed above, we are unable to distinguish between parents who were high school graduates with no college and those with some college consistently across all three surveys.

decisions of nationally representative samples graduating in the high school classes of 1992, 2004, and 2013. Pooling these surveys, we assess the post-secondary enrollment decisions of students with comparable academic proficiency and family backgrounds. Our principal estimation strategy relies on the comparison of students from the same states between survey waves.

We find substantially different patterns of tuition growth between survey waves by states. These differences are along several dimensions, including absolute and relative magnitudes, costs of community college versus public 4-year colleges, and timing. Exploiting intertemporal variation in 2- and 4- year costs within states, we estimate that in states where community college tuition doubled (the average over the study period), the likelihood of enrolling in any form of post-secondary education fell by about 0.06, on a mean of about 0.80. We also find that the increases in the costs of enrollment in community college decrease the likelihood of enrolling in community colleges and increase the chances that some students attend public 4-year institutions in their state of residence. Increasing costs at community colleges are the only source of limiting college attendance overall, consistent with the democratizing role these institutions play in higher education. Community colleges serve students who might otherwise not attend college. But rising community college costs also lead to substitution toward public 4-year colleges.

We find no evidence that changes in tuition at public 4-year colleges and private colleges limit post-secondary attendance in the aggregate, conditional on costs at other institutions. However, rising costs at public 4-year colleges limits enrollment in those colleges and diverts students to community college. This diversion is most apparent for students whose parents do not have a college education.

We find some evidence of endogeneity in cost setting at the institution level. Instrumenting intertemporal changes in institutional costs using state and local appropriations and state policy to cap tuition growth, we find that naïve estimates over-state the impact of cost increases on enrollment at 2- and 4-year colleges. Larger-than-expected tuition increases at community colleges lead to substitution away from 4-year colleges toward 2-year enrollment. This may be because institutional price setting reflects supply-side investments in community college programs and offerings. It could also derive from demand side factors that induce enrollment at community colleges in labor markets where skills obtained there are in high demand. We see a similar pattern at 4-year colleges: Institutional factors associated with tuition cost increases are positively related to enrollment growth. In states where public 4-year college costs are rising above expectations, students are less likely to enroll in private colleges.

Our results are relevant for current policy discussions about reducing the costs of college, including the push for "free college." Most directly, recent proposals to reduce costs focus substantially on reducing or eliminating the costs of community college, both to benefit those planning to attend 2-year colleges for credits or a credential, but also for those who might start at a community college and then transfer to earn a planned bachelor's degree. Our findings suggest that reducing community college costs will increase college going by a sizeable amount – about six percentage points. In our preferred control function specification, we find no evidence that reduced/no cost community college would divert students from public 4-year colleges.

Our findings also make clear the hazards of not reigning in growing costs of enrollment at public 4-year colleges. Increases in the costs of public 4-year education within states increases the chances of enrolling in community colleges, especially among students from families with

low income and parents who have not completed college. Together, our findings suggest that increasing costs of public higher education leads to a substitution of community colleges for public 4-year colleges for students on one margin, and no enrollment at all rather than community college on another margin.

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Table 1: Descriptive Statistics

	NELS: 1992		ELS: 2004		HSLS:2013	
Variable	Mean	SD	Mean	SD	Mean	SD
Female	0.51	0.50	0.53	0.50	0.52	0.50
White	0.74	0.44	0.65	0.48	0.55	0.50
Black	0.11	0.31	0.12	0.33	0.12	0.32
Hispanic	0.09	0.29	0.13	0.34	0.21	0.41
Parents are married	0.83	0.38	0.81	0.40	0.75	0.43
Mom has less than HS degree	0.12	0.33	0.10	0.30	0.08	0.28
Mom is college grad	0.26	0.44	0.29	0.45	0.32	0.47
Math Score	52.29	9.51	51.20	9.86	52.30	9.97
Attended college?	0.77	0.42	0.81	0.38	0.83	0.37
Enrolled in 4-year in-state?	0.27	0.44	0.28	0.45	0.27	0.44
Enrolled in 2-year in-district?	0.25	0.43	0.26	0.44	0.22	0.41
Enroll in other college?[1]	0.23	0.42	0.25	0.43	0.29	0.45
Part-time enrollment	0.07	0.26	0.08	0.27	0.05	0.22
In-state tuition, public 4-yr	3,602	1,246	5,668	1,848	7,825	1,938
In-district tuition, public 2-yr	1,973	973	2,670	1,078	3,350	1,025
Observations	9,515		11,530		16,556	

[1]Excluding for-profit colleges (see text for exclusion criteria)

Table 2: College Costs and Enrollment within Two Years After High School

	(1) Ever Attend College?	(2) Ever Attend College?	(3) Ever Attend College?
Female	.073***	.074***	.074***
	(.004)	(.004)	(.004)
Black	.056***	.047***	.047***
	(.007)	(.008)	(.008)
Hispanic	.029***	.023***	.023***
	(.007)	(.007)	(.007)
Other	.022***	.017***	.016***
	(.005)	(.006)	(.006)
Mom HS Dropout?	-.104***	-.104***	-.101***
	(.009)	(.009)	(.009)
Mom College Grad?	.065***	.065***	.064***
	(.004)	(.004)	(.004)
Family income, in 1000s	0.003***	0.003***	0.003***
	(0.0003)	(0.0003)	(0.0002)
Std. Math Score	.011***	.011***	.011***
	(0.002)	(0.002)	(0.002)
ln(Comm. College Costs)	-.028***	-.059***	-.058***
	(.005)	(.015)	(.017)
ln(Pub. 4 yr. College Costs)	.009	.033	.04
	(.008)	(.022)	(.029)
ln(Private College Costs)	.022***	-.046	-.057
	(.008)	(.036)	(.037)
Comm. College control fn.			-0.0002
			(.001)
Pub. 4 yr. College control fn.			-0.0003
			(0.001)
State Fixed Effects?	No	Yes	Yes
Observations	32325	32325	32189
R-squared	0.145	0.148	0.148

Huber-White standard errors in parentheses
**** p<.01, ** p<.05, * p<.1*
All models include controls for the size of a student's high school, and cohort fixed effects.

Table 3

Multinomial Logit Estimates of College Costs and College Choice

Dependent Variable: Post-Secondary Enrollment Choice

	Base Outcome: No Post-Sec. Enrollment					
	Choice 1		*Choice 2*		*Choice 3*	
	Community College		*Public 4-yr. In-state*		*Other 4-yr. College*	
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Female	.436***	.438***	.695***	.701***	.746***	.747***
	(.04)	(.041)	(.041)	(.041)	(.042)	(.043)
Black	-.004	-.006	.583***	.584***	.901***	.898***
	(.071)	(.071)	(.072)	(.072)	(.074)	(.074)
Hispanic	.051	.047	.13*	.131*	.154**	.157**
	(.065)	(.065)	(.07)	(.07)	(.073)	(.073)
Asian/Other	.039	.036	.4***	.403***	.149**	.151**
	(.067)	(.067)	(.066)	(.066)	(.069)	(.069)
Mom HS Dropout?	-.467***	-.456***	-.611***	-.593***	-.939***	-.931***
	(.062)	(.062)	(.07)	(.071)	(.088)	(.089)
Mom College Grad?	.355***	.353***	.812***	.811***	1.166***	1.167***
	(.056)	(.056)	(.053)	(.053)	(.053)	(.054)
Family income, in 1000s	.003***	.003***	.005***	.005***	.008***	.008***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
ln(Comm. College Costs)	-.857***	-.783***	-.338**	-.138	-.02	.157
	(.153)	(.176)	(.159)	(.19)	(.169)	(.206)
ln(Pub. 4 yr. College Costs)	.775***	.679**	.03	.149	.134	.426
	(.219)	(.276)	(.226)	(.281)	(.238)	(.299)
Std. Math Score	.045***	.045***	.14***	.141***	.144***	.145***
	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
ln(Private College Costs)	-.214	-.212	-.541*	-.638**	-.455	-.623*
	(.339)	(.347)	(.301)	(.306)	(.315)	(.322)
Comm. College control fn.		-.003		-.019**		-.018**
		(.008)		(.008)		(.009)
Pub. 4 yr. College control fn.		.001		-.004		-.007**
		(.004)		(.004)		(.004)
Outcome (Choice) Mean	0.211		0.288		0.303	
First-stage F-statistics, Control fn.estimates	Comm. College *F= 295.50*				Public 4.yr College *F=2345.35*	

Huber-White standard errors in parentheses

**** p<.01, ** p<.05, * p<.10*

All models control for size of high school, county unemployment, and time/cohort fixed effects.

Table 4

Marginal Effects of Tuition Costs on Post-Secondary Enrollment Outcomes

Outcome	E(Outcome)	ln(Community College Tuition) dP(Outcome)/dx		ln(Public 4-yr College Tuition) dP(Outcome)/dx	
No College	0.20	0.057	***	-0.048	
		(0.017)		(0.024)	
Enrolled - Community College	0.211	-0.109	***	0.105	***
		(0.017)		(0.026)	
Enrolled - In-State Public 4-yr College	0.288	-0.015		-0.048	
		(0.02)		(0.029)	
Enrolled - Out-of-State or Private College	0.303	0.067	***	-0.011	
		(0.02)		(0.029)	

Standard errors in parentheses

*** *p<.01*

Marginal effects of ln(tuition) change on P(outcome) calculated at control means, using delta method from model results reported in even numbered columns in Table 3

Table 5: College Tuition and Post-Secondary Enrollment, by Family Characteristics

	(1) Did not enroll in college?	(2) Enrolled in Comm. College?	(3) Enrolled in Public 4-yr (in-state)?	(4) Enrolled in Private/ Out-of-State 4-yr?
Panel A: Family Income				
Family Income < $50,000				
Log 2-yr Tuition	0.149*	-0.179***	0.071	-0.041
	(0.061)	(0.053)	(0.054)	(0.052)
Log 4-yr Tuition	-0.096	0. 035	-0.069	0.130
	(0.088)	(0.085)	(0.081)	(0.078)
Family Income > $50,000				
Log 2-yr Tuition	0.028	-0.092***	-0.018	0.082**
	(0.020)	(0.020)	(0.027)	(0.028)
Log 4-yr Tuition	-0.068*	0.067	-0.013	0.014
	(0.031)	(0.035)	(0.042)	(0.043)
Panel B: Mother Education				
Mother does not have a college degree				
Log 2-yr Tuition	0.039	-0.148***	0.060*	0.049
	(0.029)	(0.026)	(0.030)	(0.030)
Log 4-yr Tuition	-0.059	0.143***	-0.110*	0.023
	(0.042)	(0. 043)	(0.044)	(0.042)
Mother has a college degree				
Log 2-yr Tuition	0.020	-0.056*	-0.102*	0.138***
	(0.023)	.0253003	(0.040)	(0.043)
Log 4-yr Tuition	-0.036	-0.077	0.076	0.036
	(0.036)	(0.047)	(0.067)	(0.070)

Huber-White standard errors in parentheses

**** p<.01, ** p<.05, * p<.10*