

The Impact of Tuition Increases on Undocumented College Students' Attainment*

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Abstract

We examine the impact of a temporary tuition increase on undocumented college students' attainment. In spring 2002, the City University of New York reversed its policy of charging in-state tuition to undocumented students from New York. By fall 2002, the state legislature restored in-state rates. Using a generalized differences-in-differences identification strategy and a dataset that contains students' immigration status, we estimate the impact of the one-semester price increase on undocumented students' persistence, credits, grades, and degree completion. The tuition increase substantially reduced attainment, including a 19 percent decrease in the probability of degree completion within eight years of entry.

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1 Introduction

Undocumented college students lie at the intersection of policy debates about immigration reform and growing higher education costs. While efforts to pass federal legislation that would extend federal financial aid to undocumented college students have been unsuccessful, many states have extended in-state tuition benefits to these young adults. Given the limited resources at undocumented students' disposal, the in-state subsidy represents a substantial reduction in postsecondary costs; at most public four-year institutions, the out-of-state cost is more than twice the in-state cost (Hemelt and Marcotte, 2011). An extensive literature suggests that potential students are more likely to enter college following a decrease in postsecondary costs (e.g., Deming and Dynarski, 2010). However, low and decreasing college completion rates underscore the importance of understanding the impact of price shocks on enrolled students' ultimate attainment (Bound, Lovenheim and Turner, 2010).

In this paper, we estimate the impact of a tuition increase on the postsecondary outcomes of undocumented college students within a major urban university system. For a single semester, the City University of New York (CUNY) reversed its long-standing policy of charging in-state tuition rates to undocumented students from New York. For students enrolled in one of CUNY's "senior" colleges (institutions that offer both bachelor's and associate's degrees), the tuition rates more than doubled, while community college students in associate's degree programs experienced a 23 percent increase in tuition.¹ This one-semester increase offers a natural experiment for examining the effect of tuition on undocumented students' attainment, as measured by their persistence, earned credits, grades, and degree completion. We use a generalized differences-in-differences identification strategy that compares differences in undocumented and documented noncitizen students' outcomes during the tuition hike semester to the difference in their outcomes in prior semesters. Under the identifying assumption that the change in the outcomes of documented noncitizens after the price increase represent a valid counterfactual for the evolution of the outcomes of undocumented students in the absence of the price change, our approach identifies the causal impact of the tuition shock on undocumented students' attainment.

We find that the elimination of the in-state tuition subsidy led to substantial and lasting decreases in undocumented students' attainment. On average, undocumented students were 6 percent less likely to re-enroll in the semester of the price increase and 4 percent less likely to persist in subsequent semesters. Affected students earned 0.6 fewer credits (a 9 percent decrease) in the semester of the tuition shock and 0.5

¹Though postsecondary institutions are typically classified as "4-year" or "2-year", we use the CUNY System's label of "senior" college (as opposed to "4-year" college) because approximately 40 percent of senior college students started out in an associate's degree program. More importantly, associate's degree seeking students enrolled in senior colleges face the same tuition charges as those enrolled in a bachelor's degree program. Thus, the magnitude of the price change is specific to the institution, not the degree. We elaborate on this point in Section 2.

fewer credits (an 8 percent decrease) in each subsequent semester. We can rule out all but small impacts of the price increase on undocumented students' cumulative grade point average (GPA), indicating that most of the reduction in earned credits was driven by their choice to enroll in fewer courses as opposed to reduce time spent on courses.

Eight years after college entry, we estimate that undocumented students who were potentially exposed to the price increase were 19 percent less likely to receive a degree. The reduction in degree receipt is driven by senior college students, who experienced a 26 percent decrease. Conversely, although we find that the tuition increase led community college students to earn fewer credits in the short-run, we do not find significant impacts on cumulative credits earned or degree receipt within eight years of college entry.

Our paper contributes to two relatively underexplored areas relevant to the economics of higher education and immigration reform. First, we provide strong evidence that price shocks affect the outcomes of enrolled students. Research reviewed by Deming and Dynarski (2010) points to significant increases in college-going among students who experienced an exogenous drop in their effective prices due to policy changes, such as the introduction of a state merit-based aid program. However, there is less evidence on the impact of price changes on the postsecondary attainment of students after they choose to enroll. Bailey and Dynarski (2011) show that although gaps in college attendance by family income have shrunk in recent years, poor students' graduation rates have remained low, suggesting that the effects of financial need persist beyond the enrollment decision.

A handful of recent studies suggest that increases in need-based grant aid may increase persistence of enrolled students when such increases are not offset by reductions in other aid.² Using data on Ohio public college students, Bettinger (2004) finds that increases in Pell Grant aid, the main federal aid program for low-income students, increases students' persistence. Goldrick-Rab et al. (2012) examine the impact of a need-based grant program that provided additional funding to a randomly-selected group of Pell Grant recipients attending public institutions in Wisconsin. In cases when the additional grant aid was not offset by reduced borrowing, the authors find positive impacts on persistence. Consistent with this finding, Marx and Turner (2014) estimate that Pell Grant aid does not increase persistence or attainment in a setting where additional grant aid crowds-out funding from federal loans.³ Our context allows us to isolate the impact of price increases on student outcomes because undocumented students are ineligible for federal grants and loans. Therefore, we can rule out the possibility that the tuition increase in spring 2002 was offset by

²A related topic is the role of credit constraints in students' postsecondary decisions. In a setting where students faced no direct tuition charges, Stinebrickner and Stinebrickner (2008) find that most dropouts do not face credit constraints, suggesting a potentially large role for non-financial factors in students' persistence decisions.

³Castleman and Long (2013) estimate the impact of need-based grant aid on Florida high school graduates' college enrollment and attainment. They find that eligibility for the Florida Student Access Grant (FSAG) increased both initial enrollment and degree receipt. However, the positive effect of FSAG eligibility on enrollment makes it difficult to determine whether eligibility for FSAG aid increased attainment above and beyond its impacts on college attendance.

increases in grant or loan aid.

A related body of research explores the role of financial aid tied to other supports (such as mentors) or requirements (such as a minimum courseload or cumulative GPA) on degree completion. Dynarski (2008) estimates positive impacts of state merit-based aid on persistence and graduation with larger effects among female students. Scott-Clayton (2011) studies West Virginia’s PROMISE scholarship and finds positive impacts only during years in which aid was tied to performance. Results from the Student Achievement and Retention Project, an experimental study that randomly-assigned students in a Canadian university to receive financial aid (tied to grades), support services, or both, suggests higher levels of merit aid coupled with support services increased female (but not male) students’ GPA and retention rate (Angrist, Lang and Oreopoulos, 2009). However, a follow-up study that involved stronger incentives found smaller impacts on achievement (Angrist, Oreopoulos and Williams, forthcoming). Finally, a series of papers examine the impact of randomly-assigned performance-based monetary incentives across students and find evidence of small but statistically significant impacts. Finally, a series of papers examine the impact of randomly assigned student incentives and find evidence of small impacts (e.g., Patel and Rudd, 2012; Barrow et al., forthcoming). Although most of these studies find modest effects on enrolled students’ persistence and attainment, it is difficult to separately identify the effect of aid from the effect of other supports or incentives. Our study permits estimation of tuition price effects independent of effects driven by other incentives or supports.

This paper’s second contribution is to provide direct evidence on how tuition shocks affect the attainment of undocumented college students. Like other low-income, first generation college students, undocumented students are likely more price sensitive than the average college student (Gonzales, 2011). Undocumented students also face a severely restricted labor market, which may render a college degree less (or perhaps more) valuable to them than other low-income students. Understanding the effect of tuition and aid policies on this population is particularly important as recent discussions around immigration reform have focused on providing undocumented youth with a pathway to citizenship through college attendance and completion.

Four prior studies use national survey data and a standard difference-in-difference framework to estimate the effects of in-state tuition subsidies on undocumented students’ college enrollment decisions. Three of these studies find positive effects on Mexican (or Hispanic) non-citizen students’ college enrollment (Chin and Juhn, 2011; Darolia and Potochnick, 2014; Flores, 2010; Kaushal, 2008).⁴ However, as these national surveys do not distinguish between documented and undocumented noncitizens, such analyses potentially misestimate aid effects on undocumented students’ enrollment. In addition, there is limited evidence on how

⁴Kaushal (2008), Chin and Juhn (2011), and Darolia and Potochnick (2014) examine the average effects of in-state tuition programs offered in all states, while the Flores (2010) study focuses on the effects of the Texas program. All studies rely on data from the Current Population Survey (CPS) or the American Community Survey (ACS) and proxy for undocumented status with Mexican (or Hispanic) students who are not citizens. The three studies that find positive estimates suggest that eligibility for the in-state tuition subsidy increased college enrollment by 2 to 6 percentage-points.

aid affects undocumented students' further attainment once enrolled.

The remainder of this paper proceeds as follows: in Section 2, we describe the CUNY system and provide background information on the circumstances of undocumented young adults. We discuss our data and sample in Section 3 and describe our empirical approach in Section 4. In Section 5, we present estimates of the impact of the price increase on undocumented students' attainment during the semester of the policy change and in the immediately following semesters. Section 6 presents our estimates of the impact of the tuition increase on longer-run outcomes, including degree receipt, while Section 7 concludes.

2 The CUNY System and Undocumented Students

As an established immigrant gateway, New York is home to approximately three million foreign-born residents, an estimated 625,000 of whom are undocumented (American Community Survey, 2010; Passel and Cohn, 2010). The Fiscal Policy Institute (2012) estimates that approximately 5,500 undocumented students are enrolled in New York state colleges, with most likely residing in New York City and enrolling in one of the CUNY System institutions.

In the period we examine, the CUNY System included 11 senior colleges and 6 community colleges. We label CUNY schools as senior or community colleges instead of using the standard labels of two- or four-year institutions because four of the 11 senior CUNY colleges offer both associate's and bachelor's degree programs. This practice is not unique to the CUNY System; according to data from the Integrated Postsecondary Education Data System, in 2013, 60 percent of public institutions classified as four-year colleges also offer certificate or associate's degrees. In addition, students in the CUNY senior colleges who are enrolled in an associate's degree program are charged the same tuition rates as those in a bachelor's degree program. In 2001, nominal in-state tuition for a full-time student was \$3,200 per year at senior colleges and \$2,500 per year at community colleges.

Our identification strategy relies on unanticipated shocks to undocumented students' eligibility for these in-state rates. In 1989, long before any US state considered granting in-state tuition to undocumented students, Mayor Edward Koch issued an executive order that extended in-state rates to CUNY students who lacked documentation but who could demonstrate that they graduated from a New York high school or received a GED from the state.⁵ Yet in the fall of 2001, shortly after the terrorist attacks of September 11, the CUNY Chancellor overturned the policy and announced that the university would charge undocumented students who had previously qualified for the in-state subsidy out-of-state tuition rates.⁶ CUNY's new tuition

⁵See, for instance, Marvine Howe's 1989 *New York Times* article "CUNY to Enroll Some Illegal Aliens as Residents." Downloaded on 2/1/2014 from <http://www.nytimes.com/1989/08/09/nyregion/cuny-to-enroll-some-illegal-aliens-as-residents.html>.

⁶See, for instance, Karen W. Arenson's 2001 *New York Times* article, "CUNY raises tuition rates for foreigners here ille-

policy was in place for exactly one semester (spring of 2002) and was subsequently overturned by the New York State legislature, which passed a law in the summer of 2002 that reinstated in-state tuition benefits for eligible undocumented students. During the spring of 2002 only, the tuition rates for undocumented students at senior colleges (including those in associate's and bachelor's degree programs) more than doubled (from \$133 to \$283 per credit). With a full-course load of 12 credits, this represented a tuition increase of \$1,800 in the spring of 2002. For undocumented community college students, the price increase was smaller (from \$104 to \$128 per credit), with the policy change increasing full-time students' tuition by approximately \$300 (23 percent).

2.1 Characteristics and outcomes of undocumented students

The Pew Hispanic Center estimates that there are approximately 1.7 million undocumented immigrants under the age of 31 who migrated to the US at before they were 16 (Passel and Lopez 2012). Advocates for undocumented youth have proposed the *Development, Relief, and Education for Alien Minors* (DREAM) Act, which would provide eligible youth with a pathway to permanent residency status and access to federal benefits, such as aid for college.⁷ Congress voted against the DREAM Act in 2001, 2007 and 2010. In 2012, the Obama administration announced the *Deferred Action for Childhood Arrivals* (DACA) program, which is an executive order that shields eligible undocumented immigrants from deportation and provides them with temporary work authorization. In addition, over a dozen states have passed legislation to extend in-state tuition benefits to eligible undocumented college students.

Despite the ample policy attention given to undocumented college students, there are few large-scale analyses of their achievements because federally-sponsored surveys and other administrative data sources are prohibited from asking respondents to state their immigration status. Several qualitative studies of undocumented students identified through non-probabilistic sampling methods find that students who lack documentation face substantial barriers to college success (Abrego, 2006; Contreras, 2009; Gonzales, 2011; Muñoz and Maldonado, 2012; Perez, 2009). Most undocumented students come from families with limited financial resources and parents who are themselves undocumented and unable to provide guidance and support in navigating US institutions. Thus, undocumented students face many of the same hurdles faced by other low-income, first generation, college students. Their lack of documentation poses greater challenges to normal college pursuits, such as obtaining driver's licenses, places to live, student identification cards, and employment both off and on campus (Contreras, 2009; Muñoz and Maldonado, 2012).

gally." Downloaded on 2/2/2014 from <http://www.nytimes.com/2001/11/03/nyregion/cuny-raises-tuition-rates-for-foreigners-here-illegally.html>.

⁷In addition to removing the threat of deportation and the opportunity for legal employment, the bill encourages college enrollment by offering a pathway to legalization for students who obtain a college diploma.

At the same time, these studies suggest that undocumented youth demonstrate a high level of ambition and resilience. Consistent with this anecdotal evidence, Conger and Chellman (2013) find that undocumented students in the CUNY System tend to resemble other noncitizen immigrant groups (namely permanent residents and visa holders) on academics, all of whom earn higher GPAs and complete more credits than US citizens. These findings are in line with the research on immigrant students in the K-12 system, which often finds that they are a positively-selected group who outperform native-born students with observably-similar race and class profiles (e.g., Kao and Tienda, 1995; Schwartz and Stiefel, 2006).

In short, many undocumented college students appear to fall in the category of high-ability, low-income students. As low-income students, they should be highly responsive to tuition shocks. Furthermore, they are ineligible for most other sources of financial aid and loans and are less able to compensate for tuition increases with anything other than employment in the informal labor market or loans from family members or selected private lenders. Tuition increases should have unambiguous effects on the marginal undocumented student's short-term decisions. Following the news that tuition will increase in the next semester, we would expect some undocumented students to drop- or stop-out, shift to part-time enrollment, and/or devote less time to their schoolwork.⁸

3 Data and Sample

Our analyses rely on administrative data from the CUNY System. We observe first-time, degree-seeking students' demographic characteristics and academic outcomes. Crucially, CUNY records students' citizenship and immigration status in the US for the purpose of tuition determination. Upon enrollment, students are asked to identify themselves as US citizens, permanent residents, student or temporary visa holders, asylees or refugees, or undocumented.⁹ Students are also required to submit documentation to validate their self-reported status and those who either report that they are undocumented or who fail to provide valid documentation (e.g., current visa, temporary authorizations to live and work in the US) are recorded as undocumented.

⁸While some students can also choose to lower their consumption, two-thirds of students enrolled in the CUNY System already live with their parents or guardians making reductions in housing consumption less of an option for lowering the cost of attendance. See CUNY's "2012 Student Experience Survey," available at: <http://cuny.edu/about/administration/offices/ira/ir/surveys/student/SES2012FinalReport.pdf> for further details (accessed 23 September 2014).

⁹A US citizen is an individual who either was born in the US or obtained citizenship through the process of naturalization. Permanent residents (also known as green card holders) are defined by the US Citizenship and Immigration Services as "any person not a citizen of the United States who is residing in the U.S. under legally recognized and lawfully recorded permanent residence as an immigrant" (see the U.S. Citizenship and Immigration Services Glossary, available at: <http://www.uscis.gov/tools/glossary>). Visa holders are individuals who reside in the U.S. temporarily for a specific purpose, typically to work or attend school. Finally, an undocumented immigrant is one who does not have legal authority to live or work in the US. This status is achieved either by entering the country illegally, or by violating the terms of a legal visa. US citizens and permanent residents are eligible for all forms of aid and loans from governmental and private sources. Most visa holders are ineligible for these sources of aid, with the one exception being Cuban and Haitian entrants.

To qualify for in-state tuition, undocumented students are required to submit a notarized affidavit stating that they plan to legalize their status as soon as they are eligible. These students also must demonstrate that they received their secondary schooling in New York State, either from a New York high school or GED program.

Our main sample consists of the 21,022 noncitizen students who obtained a high school diploma or GED from New York State and entered an associate's or bachelor's degree program at one of the CUNY colleges between fall 1999 and fall 2001.¹⁰ We focus on these students' outcomes during the seven semesters that surround the tuition shock: fall 2000 through fall 2004 (with spring 2002 at the center of the series), although we also show that our results are robust to larger and smaller windows.

Table 1 displays the characteristics of the full set of New York State residents who entered a CUNY institution between fall 1999 and fall 2001, by citizenship and documentation status.¹¹ Noncitizens make up 32 percent of the total population of 64,750 in-state students during these semesters and undocumented students represent approximately 4 percent. The final three columns display p -values from tests of the equality of the characteristics of citizen versus noncitizen students, undocumented versus documented noncitizens, and all three groups, respectively. Although many of the differences in characteristics are statistically significant, by in large, these differences are small in magnitude.

Compared to noncitizens, CUNY students with US citizenship are younger, more likely to be Hispanic or White and less likely to be Asian. Citizens are also slightly more likely to be classified as disabled at entry. Although citizens enter CUNY with lower high school achievement, as measured by the CUNY college admissions average, a standardized measure of high school GPA ranging from 0 to 100, they are less likely to require remediation compared to noncitizens.

Documented and undocumented noncitizen students also differ by their racial/ethnic background; undocumented students are more likely to be Black and less likely to be White or Asian than their documented noncitizen counterparts. Undocumented students are the least likely of the three groups to pursue a bachelor's degree at entry, and enter less selective CUNY institutions than citizens and documented noncitizens.¹²

The similarities between citizen and noncitizen students highlight one of the unique features of our study location. New York City is one of the largest cities in the US with a relatively diverse student population (of both natives and immigrants) and undocumented immigrants from all over the world, not just from Latin

¹⁰Restricting our sample to students who earned their high school diploma or GED in New York State excludes approximately 300 undocumented students (12 percent) and 14,000 documented noncitizens (42 percent). We impose this restriction to increase the comparability of documented and undocumented noncitizens; out-of-state students were subject to higher tuition rates at entry, and thus likely face fewer financial constraints relative to in-state students.

¹¹Appendix Tables A.1 and A.2 display the characteristics of senior and community college students separately.

¹²The Barron's Guide places the following colleges in each rank: Very Competitive includes Baruch; Competitive includes Brooklyn, City, Hunter, John Jay, and Queens; Less Competitive includes Lehman; Non Competitive includes City Tech, Medgar Evers, New York City College of Technology, Staten Island, and York; Non Selective includes Borough of Manhattan Community College and Bronx, Hostos, Kingsborough, LaGuardia, and Queensborough Community Colleges.

or South America as is common in other regions. Thus, the responses of CUNY undocumented students to tuition shocks may not resemble the responses that other undocumented students across the nation might show. We address concerns over the generalizability of our estimates by examining whether the impact of the tuition increase varies by race/ethnicity.

4 Empirical Framework

Our setting allows us to address several challenges that are inherent to estimating the effect of prices on current students' postsecondary outcomes. First, the decision to reverse the in-state tuition policy appears to have been made in reaction to 9/11 and not to any patterns observed among undocumented students or documented students (Rincón, 2010). Thus, there is no reason to expect that the students who experienced the price change differ from their unaffected counterparts on relevant drivers of attainment, such as financial need, courses, institutions, or grades. Second, undocumented students are ineligible for most other sources of federal, state, or private grant aid and loans, which means that most undocumented were unlikely to buffer the tuition hike with other financial support.¹³ In addition, no exceptions to the policy appear to have been made, or additional supports made available, rendering all previously-eligible undocumented students subject to the same price increase.¹⁴ This unique circumstance means that the estimates will more closely measure the theoretical effects of tuition shocks on postsecondary attainment than studies that examine the effect of a specific subsidy (e.g., Pell Grant aid) on students who have access to other financial resources.

Additionally, our data and context allow us to overcome a challenge faced by researchers examining the outcomes of undocumented youth. Most surveys do not request that respondents state their immigration status or provide documentation to validate their responses. Thus, the handful of studies that have examined the effect of in-state tuition subsidies on undocumented students code both undocumented students and other noncitizen immigrants (namely, those with legal visas and permanent residents) as treatment group members, leading to measurement error that likely biases estimates. These studies also cannot rule out the possibility that changes in tuition policies have spillovers to documented noncitizens via reductions in “chilling” effects.¹⁵ We address this challenge by using documented noncitizens as our primary control group. If the tuition increase led noncitizens to feel less welcome in the CUNY System, we can difference out these nonprice impacts on attainment.

¹³Undocumented students are ineligible for all federal sources of aid and loans, including the Pell and Stafford programs. They are also ineligible for the New York Tuition Assistance Program (TAP), the New York State funded grant to low-income students of up to \$5,000.

¹⁴Even in the absence of actions taken by the student, institutions have been found to respond to changes in Pell Grant aid by altering institutional grant aid (Turner, 2014).

¹⁵For instance, Watson (2014) examines the “chilling effect” of policies targeting undocumented immigrants on documented immigrants' behavior and finds evidence of lowered Medicaid take-up among eligible noncitizens.

Finally, the fact that the policy was in place for only one semester reduces the category of biases to other events that disproportionately touched undocumented students in that semester, but not before or after. The identifying assumption underlying our research design is that in the absence of the tuition increase, differences between the choices of documented and undocumented students in the spring of 2002 would have been the same as this difference in the semesters immediately prior to spring of 2002.

To estimate the effects of the policy change, we focus on outcomes in the three semesters surrounding the policy change and the semester of the price shock: fall 2000 through fall 2004. We estimate generalized differences-in-differences models, where we allow the impact of the policy change to have persistent effects after the policy change was reversed:

$$Y_{icst} = \beta_1 Treat_t + \beta_2 Undoc_i + \beta_3 Treat_t \times Undoc_i + \beta_4 Post_t + \beta_5 Post_t \times Undoc_i + \gamma \mathbf{X}_i + \delta_{sc} + \delta_t + \epsilon_{icst} \quad (1)$$

Where Y_{icst} is one of several attainment outcomes in semester t for student i who initially enrolled in school s as a member of cohort c ; $Undoc_i$ is set to one if the student is undocumented; \mathbf{X}_i is a vector of student covariates measured in the first semester of college including need for high school grade point average, remediation, disability, age, gender, race/ethnicity, and single parent status; δ_t and δ_{sc} are semester and school-cohort fixed effects, respectively, and ϵ_{icst} is a random error component. We estimate models that pool students across institutions and separate models for students enrolled in senior and community colleges. Student-semester observations are dropped following degree receipt.¹⁶

The coefficient on the interaction between the treated semester and undocumented status, β_3 , represents the change in the outcome of interest during the semester of the tuition hike on the outcomes of undocumented students relative to documented noncitizens. Additionally, β_4 represents the change in outcomes for undocumented students in the semesters after the tuition hike (compared to the semesters before the increase) relative to the same change for documented noncitizens. Standard errors are clustered at the cohort by college level.

A possible violation of our identifying assumption would be underlying trends in the outcome variables that are correlated with the policy change. Examination of the pre-policy trends, discussed in the following section, suggests no correlation between an underlying trend and the policy change. Yet in this unusual case, a stronger potential violation is the terrorist attacks of September 11, 2001. These attacks had a major impact on New York City residents and their institutions and may have uniquely influenced the schooling choices of the city's immigrant students. If the undocumented students felt disproportionately impacted,

¹⁶Only 2 percent of student by semester observations are dropped due to this restriction.

perhaps reducing their schooling investments, then observed changes in spring 2002 could be due to the terrorist attack and not to the change in the tuition policy. Though we are unable to directly examine the academic response to 9/11, we estimate differences-in-differences-in-differences (DDD) models to examine whether the policy change led to significant impacts on the outcomes of documented noncitizens (relative to citizens). Documented noncitizens at CUNY were not directly subject to the new tuition policy, but they were subject to the post 9/11 environment in the city and may have reacted to the new CUNY policy towards undocumented immigrants if this policy was perceived as hostile towards noncitizens. We search for evidence of a response from these students in an effort to evaluate our main identifying assumption.

5 The Impact of Tuition Increase on Attainment

Figures 1 through 4 illustrate our identification strategy and preview our main results by plotting average persistence, credits attempted, credits earned, and cumulative GPAs of citizens, documented noncitizens, and undocumented students over the seven semesters surrounding the policy change.¹⁷ The vertical lines surround the semester of the policy change, the solid black line represents the average outcomes of undocumented students, the dashed dark gray line represents the average outcomes of documented noncitizens, and the solid light gray line represents the average outcome of citizens. Thus, the difference between the black and dashed gray lines before the policy change to the difference between these outcomes in the semester of the tuition increase approximates our differences-in-differences estimate. Because students in senior and community colleges faced different price increases, we separately examine students who initially enrolled in a senior college and those who enrolled in a community college.

Panel A of Figure 1 displays average persistence among CUNY students who initially entered a senior college.¹⁸ Prior to spring 2002, both groups of noncitizens were more likely to re-enroll than citizens following college entry, while persistence rates for documented noncitizen and undocumented students were quite similar. The general decline in the lines for all groups also reflect the increasing drop-out rate as each semester passes. Yet in the spring of 2002, when undocumented students' tuition rates doubled, enrollment drops substantially, landing approximately 5 percentage-points below their documented noncitizen peers. The graph also reveals that undocumented students' enrollment rebounds slightly after in-state tuition rates were restored. Similarly, Panel B displays trends in persistence among community college students. Two semesters prior to the policy change, undocumented and citizen students appear to have larger decreases than documented noncitizens, but the rates trend similarly after that point and there is little evidence that

¹⁷Persistence represents enrollment in the current semester, independent of enrollment in a prior semester.

¹⁸We exclude observations of students in their first semester of enrollment, since, by definition, the enrollment rate is 100 percent.

the price increase affected the persistence of undocumented community college students.

Figures 2 and 3 display trends in credits attempted and credits earned, respectively, for senior college (Panel A) and community college students (Panel B). In general, documented noncitizens attempt and earn more credits than undocumented students and citizens. Undocumented students attempt and earn more credits than citizens before the policy change. Yet in the semester of the price increase, undocumented students' attempted and earned credits decrease by more than that of documented students, suggesting that the policy change reduced both credits attempted and earned. Again, following spring 2002, undocumented students' outcomes did not fully rebound. The changes in credits attempted and earned among undocumented students relative to their documented noncitizen counterparts are less severe for community college students.

Finally, trends in cumulative GPAs for documented noncitizen and undocumented students enrolled in senior colleges are similar, undocumented students earning only slightly lower GPAs than documented noncitizens before and following the price increase (Figure 4, Panel A). Among community college students, undocumented immigrants have lower grades than documented noncitizen students, but there is no evidence that the price increase had immediate or persistent impacts on grades (Panel B). In both cases, citizens' cumulative GPAs are lower than noncitizens. In addition to finding no impact of the price increase on grades, our results suggest that observed decreases in credit accumulation are largely driven by decreases in credits attempted. Thus, while we focus on estimating impacts on credits earned in our regression analyses, estimated impacts on credits attempted are nearly the same (available upon request).

5.1 Regression results

Table 2 reports the coefficients and standard errors on the interaction of undocumented status and indicators for the semester of the price increase (spring 2002) and semesters following the price increase (post-spring 2002) from estimation of Equation (1). We examine impacts on persistence, credits earned, and grades. The first column contains estimates pooling students enrolled in senior and community colleges, while the second and third column provide separate estimates.

Our regression estimates are consistent with the unadjusted comparisons in outcomes between documented and undocumented students shown in the figures. As shown in Panel A, we estimate that the policy change led to a 4 percentage point (6 percent) decrease in the probability of persistence for undocumented students and a 3 percentage point (4 percent) decrease in persistence per semester after the price change was reversed. However, only the estimated impacts on senior college attendees are statistically significant.¹⁹

¹⁹We can reject the equality of the estimated impact of the price increase for two- and four-year students with $p = 0.061$. However, the difference in the estimated impact of the price change after spring 2002 is not statistically significant ($p = 0.551$).

Undocumented students at both types of colleges experienced decreases in credits earned in spring 2002 and the following semesters (Panel B). Undocumented senior college students earned 0.7 fewer credits in spring 2002, a 9 percent decrease, and 0.5 fewer credits in each subsequent semester, a 7 percent decrease. Undocumented community college students experienced decreases in attainment that were slightly smaller in magnitude, although due to their lower pre-policy change levels of attainment, these decreases represented larger changes in percentage terms. Undocumented community college students experienced a 10 percent decrease in credits earned in spring 2002. In each subsequent semester following the price increase, these students experienced a 9 percent decrease in credits earned. None of the differences in point estimates between senior and community college students are statistically significant.

Finally, we find no evidence that the tuition increase affected undocumented students' cumulative GPAs. Our 95 percent confidence interval rules out impacts larger than a 0.03 increase and a 0.04 decrease in cumulative GPA for senior college students in spring 2002. We can rule out impacts larger than a 0.03 increase and a 0.06 decrease for undocumented community college students.

We also investigate whether the impact of the price increase on senior college students differed by students' initial degree program, since some senior colleges contain both bachelor's and associate's degree seeking students. As shown in Appendix Table A.3, none of the differences in the estimated impact of the price increase by degree program are statistically significant.

5.2 Robustness: impacts on documented noncitizens

One of the key concerns with our identification strategy is that the terrorist attacks of September 2001 generated a unique response among the immigrant students in New York City, perhaps causing them to reduce their schooling investments. Additionally, the in-state-tuition reversal for undocumented students may have led documented noncitizens to feel unwelcome in the CUNY System.

We test for impacts on documented noncitizen students by estimating DDD models, where we add to our estimating sample the US citizens who received their high school diploma or GED from New York State and belonged to one of the cohorts who entered a CUNY degree program prior to the policy change. We estimate equation (1) and include additional interaction terms between the indicator for the "treated" semester and post-spring 2002 with an indicator for whether a student is a noncitizen (regardless of documentation). This specification allows for comparison among all three groups of students. The logic of this test is that we should observe differences between citizens and documented noncitizens in the tuition hike semester if the instability generated by the terrorist attacks or the new CUNY policy affected other students who lacked the full protections of citizenship.

As shown in Table 3, we find little evidence that the policy change had any impact on documented noncitizens' outcomes. Only in the case of community college students do we find any evidence of an impact of the tuition hike on documented noncitizens' outcomes, and these impacts are marginally significant and small in magnitude. Conversely, the estimated impact of the policy change on undocumented students' persistence and credits earned remains negative, statistically significant, and quite similar to estimates shown in Table 2. This exercise does not entirely rule out 9/11 as a cause of changes in enrollment for undocumented, but it suggests that 9/11 cannot be the only explanation. It also indicates no substantial chilling effects of CUNY's decision to remove the in-state subsidy.

5.3 Additional robustness tests

Tables 4 and 5 display estimated impacts on enrollment and credits earned from additional robustness tests. Column (1) includes estimates from models that include student fixed effects. In the column (2) specification, the sample is limited to students who were enrolled in fall 2001, the semester before the price increase. Column (3) contains estimates from models that use a larger window around the policy change (4 semesters) and column (4) contains estimates from models that use a smaller window (2 semesters).

Our fixed effects models will account for student-specific time-invariant characteristics. To the extent that students' time-invariant unobservable characteristics are correlated with both their attainment and exposure to the policy change, our main results will suffer from omitted variables bias. Conversely, our fixed effects models use a given student's pre-treatment outcome as their counterfactual outcome in the absence of the policy change. In this case, documented noncitizens only allow us to identify cohort by school and semester fixed effects, as these students experience no change in their exposure to the tuition increase. The disadvantage of using student fixed effects is that attenuation bias due to measurement error in the "treatment" variables will be exacerbated, biasing our estimates towards zero. Even if documentation status contained minimal measurement error, our "treatment" variable will contain measurement error by construction. This is because not all students are still enrolled in spring 2002, but we treat all students as being affected by the price increase.

Our second robustness test conditions on enrollment in fall 2001. This allows us to focus on students who could have potentially been affected by the price increase. However, this population is different from the students who initially enrolled in the cohorts we focus on, so we might not necessarily expect to find the same effects if price increases have heterogeneous treatment effects. Our final two robustness tests vary the size of the window around the policy change that we include in our sample, to show that our results are not driven by the specific 3-semester window we use in our main specification.

Overall, we find similar impacts of the price increase on undocumented students' enrollment using these alternative models (Table 4). Although the student fixed effects model produces a smaller estimated impact of the price increase on enrollment (a 5 percent decrease for senior college students and a 2 percent decrease for community college students), these point estimates are not statistically distinguishable from our main estimates shown in Panel A of Table 2. When we limit the sample to students still enrolled in fall 2001, our point estimates increase in magnitude and the impact of the price increase on undocumented community college students' enrollment is statistically significant. Including a larger window of semesters around the price increase results in estimates that are quite similar to our main results. Limiting the sample to two semesters before and after the price increase results in smaller point estimates that are statistically indistinguishable from our main results.

The estimated impacts of the policy change on credits earned are quite robust to these alternative specifications (Table 5). Among senior college students, the estimates suggest that the price increase led to an 8 percent decrease in credits earned in spring 2002, and a 5 to 7 percent decrease in each subsequent semester. Among community college students, estimates suggest that the price increase resulted in an 8 to 11 percent decrease in credits earned in spring 2002 and a 6 to 10 percent decrease in credits earned in the following semesters. Impacts on cumulative GPA are also robust to these alternate specifications and can be found in Appendix Table A.4.

5.4 Heterogeneity by gender and race/ethnicity

Prior research suggests greater sensitivity to tuition supports among female compared to male bachelor's degree seeking students (e.g., Angrist, Lang and Oreopoulos, 2009; Dynarski, 2008). To determine whether the price increase had larger impacts on female undocumented students' attainment, we estimate equation (1) using fully-interacted models (Table 6). We find no evidence of heterogeneous impacts of the price change on senior college students' outcomes by gender. However, among community college students, we find marginally significant heterogeneity in the impact of the price increase on persistence, both in spring 2002 and in the immediately following semesters. While the policy change did not significantly affect female undocumented students' re-enrollment decisions, it led to a 5 percentage point decrease in male students' probability of re-enrollment in spring 2002 and a similar decrease in subsequent semesters.²⁰

Next, we test for heterogeneous impacts of the price increase on attainment by race/ethnicity. Again, we fully interact equation (1) with a set of indicators for students' race/ethnicity. We exclude students classified as Native American due to the small size of this group. Results are displayed in Table 7. Although

²⁰Specifically, we can reject the hypothesis that the interaction between undocumented status and Spring 2002 is equal for male and female students with $p < 0.059$ and can reject the hypothesis that the interaction between undocumented status and post-Spring 2002 is equal with $p < 0.079$.

the differences in point estimates are not statistically significant, among both community and senior college students, undocumented Hispanic students' show the largest reduction in credits earned in spring 2002 and in the following semesters. For instance, senior college Hispanic undocumented students earn approximately 1.2 fewer credits in spring 2002, and community college Hispanic undocumented students earn 0.9 fewer credits.

5.5 Implied impacts of price increases on undocumented students' attainment

Senior and community college students experienced different price increases in spring 2002. To translate our point estimates to represent the impact of a \$1,000 price increase on undocumented students' attainment, we scale the point estimates by the price increase undocumented students would have been exposed to had they been enrolled full-time during the semester before and the semester of the price increases. Full-time senior college undocumented students experienced a \$1,800 tuition increase, while full-time community college students experienced a \$300 increase.

Our estimated impacts of the price increase on persistence, reported in Panel A of Table 2, suggest that a \$1,000 increase in price results in a 3 percentage point decrease in persistence among senior college students and a 7 percentage point decrease in community college students' probability of re-enrollment. Likewise, a \$1,000 increase in price leads to 0.4 fewer credits earned for senior college students and over 2 fewer credits earned among community college students (Table 2, Panel B). Thus, while the magnitude of the estimated impact of the policy change for community college students is smaller than for senior college students, the actual impact of a price increase is much larger, suggesting that undocumented community college students may be more responsive to price changes.

6 Degree Receipt and Longer-Run Outcomes

Our results suggest that the tuition change decreased senior and community college undocumented students' credit accumulation, due largely to a decrease in credits attempted as opposed to courses completed. Given the immediate and persistent reductions in credit receipt following the price increase, we next examine whether the policy change had significant impacts on degree receipt. To do so, we compare changes in the outcomes of undocumented students in cohorts who entered in the five semesters before the policy change to those who entered in the five following semesters (omitting the spring 2002 cohort) relative to changes in the outcomes of documented noncitizen students, while controlling for school by year fixed effects, cohort linear time trends (allowed to vary by documentation status), and a set of controls for student demographic characteristics.

We examine impacts on cumulative credits earned eight years after college entry and receipt of any degree, and specific degrees (associate’s and bachelor’s degrees) within four and eight years of entry (Table 8). In Panel A of Table 8, we pool community and senior college students. We estimate that undocumented students in cohorts that were potentially affected by the price increase earned 6 fewer cumulative credits (measured eight years after entry), representing a 9 percent decrease. Although we find no effect of the price increase on the probability of earning a degree within four years of entry, we estimate that the price increase led to a 8 percentage point (19 percent) decrease in the probability of degree receipt within eight years of entry. Looking at impacts on specific degree receipt, we find evidence that the price increase decreased undocumented students’ probability of receiving associate’s and bachelor’s degrees, although only impacts on associate’s degree receipt are statistically significant.

Panels B and C of Table 8 display results from models that separate senior and community college students. We find no evidence of statistically significant impacts on undocumented community college students’ ultimate attainment. However, we estimate that the price increase led to large and statistically significant reductions in cumulative credits earned and degree receipt among undocumented students in the senior colleges.²¹

Undocumented students who initially entered a senior college and who were affected by the price change earned 8.5 fewer credits eight years after college entry, an 11 percent decrease. They were 5 percentage points less likely to have earned a degree within four-years, primarily driven by a reduction in associate’s degree receipt. Eight years after college entry, impacts of the price increase on senior college undocumented students’ degree receipt are even larger. These students were 13 percentage points (26 percent) less likely to have earned any degree and 7 percentage points less likely to have earned both associate’s and bachelor’s degrees, representing 94 percent and 15 percent decreases, respectively.²²

7 Conclusions

Our results suggest that the CUNY decision to temporarily remove in-state tuition benefits to eligible undocumented students enrolled in one of its senior colleges led to decreases in persistence, credit accumulation

²¹We also test whether the price increase affected associate’s degree receipt within two years of college entry and find no evidence of impacts. However, only 2 percent of senior college students and 6 percent of community college students have earned an associate’s degree within 2 years of college entry.

²²In Appendix Table A.4, we separately examine impacts of the price increase on the outcomes of senior college student by initial degree program. Only bachelor’s degree seeking students’ credit accumulation is significantly affected by the policy change, although we cannot reject the hypothesis that impacts on bachelor’s and associate’s degree seeking students within senior colleges are equal ($p = 0.298$). We do find evidence of statistically distinguishable impacts on receipt of specific degrees within eight years of college entry: the price increase had significantly larger impacts on AA degree receipt among AA-degree seeking undocumented students ($p = 0.003$) and on BA degree receipt for BA-degree seeking students ($p = 0.055$). However, impacts on whether a student earned any degree within this time frame are not statistically distinguishable by initial degree program.

and, ultimately, degree attainment. We find similar impacts on undocumented community college students' credit accumulation at the time of the price increase and in following semesters, although ultimately, community college students in cohorts affected by the price increase did not experience a significant decrease cumulative credits received eight years after entry. Other documented noncitizens did not experience the same decreases, which helps to rule out the terrorist attacks of 9/11 or a chilling effect of the tuition hike as the sources of these changes in undocumented students' attainment.

Although we find no evidence of impacts on undocumented community college students' long-run attainment, the price increase had substantial impacts on students' long-run human capital accumulation. Undocumented senior college students in entry cohorts that were potentially affected by the price increase experienced an 11 percent decrease in cumulative credits and a 26 percent fall in the probability of degree receipt.

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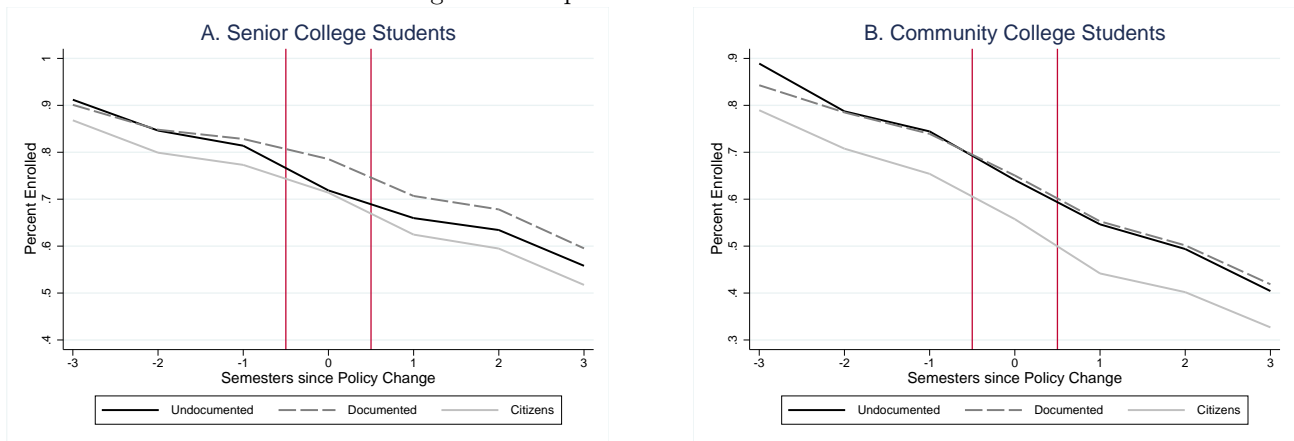
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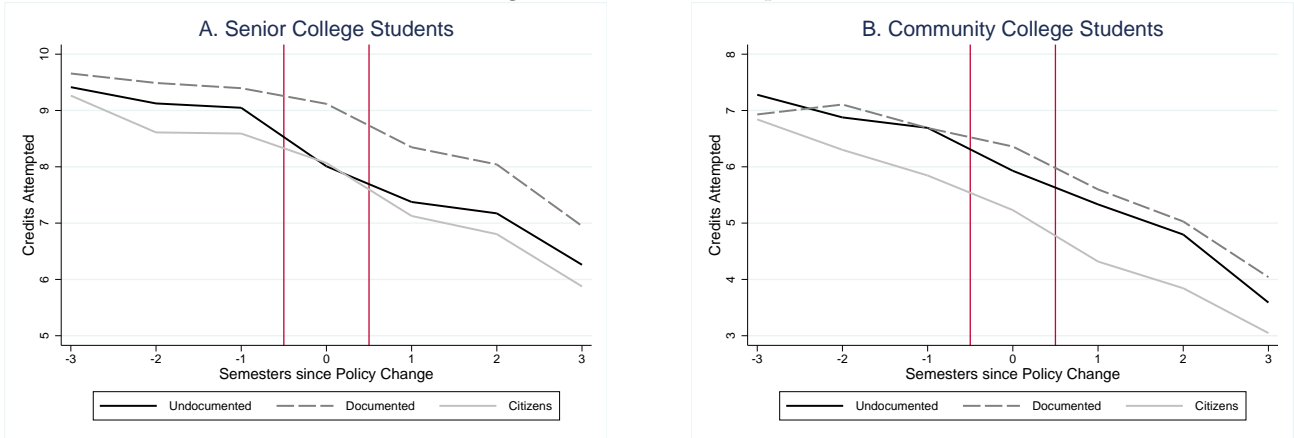
Figures and Tables

Figure 1: Proportion of Students Enrolled



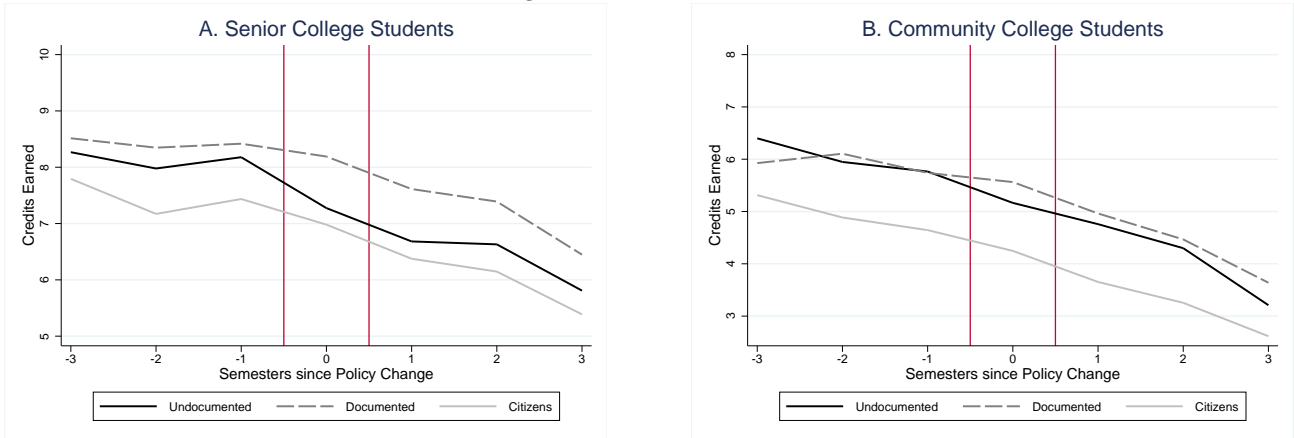
Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who earned a high school diploma or GED from New York State. Each line represents the share of students in the specified group who were enrolled in a given semester. Spring 2002 is represented by “0”. Panel A limits the sample to students who initially enrolled in a senior college and Panel B limits the sample to students who initially enrolled in a community college. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped. Observations from semester of initial enrollment are dropped.

Figure 2: Credits Attempted



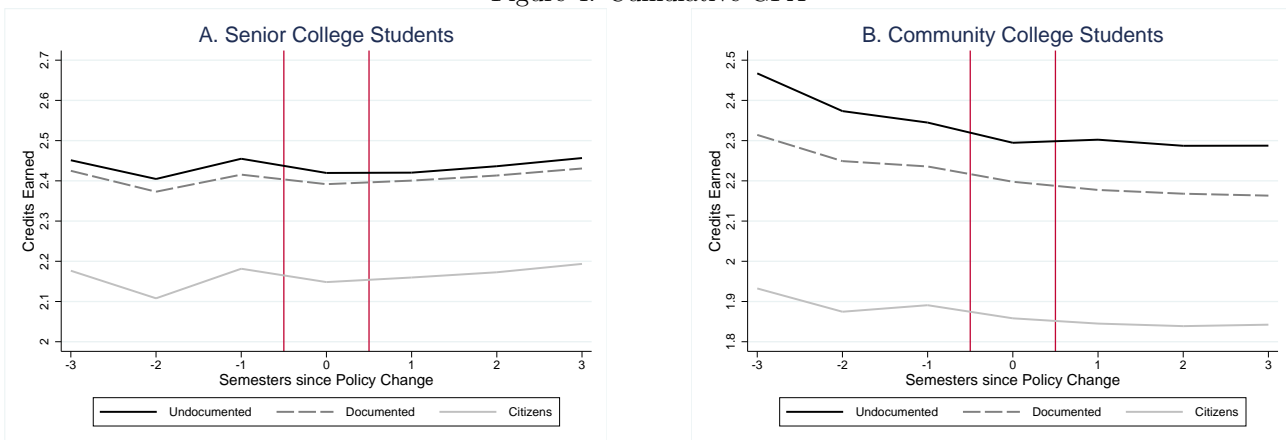
Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who earned a high school diploma or GED from New York State. Each line represents average credits attempted among students in the specified group and semester. Spring 2002 is represented by “0”. Panel A limits the sample to students who initially enrolled in a senior college and Panel B limits the sample to students who initially enrolled in a community college. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 3: Credits Earned



Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who earned a high school diploma or GED from New York State. Each line represents average credits earned among students in the specified group and semester. Spring 2002 is represented by “0”. Panel A limits the sample to students who initially enrolled in a senior college and Panel B limits the sample to students who initially enrolled in a community college. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 4: Cumulative GPA



Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who earned a high school diploma or GED from New York State. Each line represents average cumulative GPA for students in the specified group and semester. For students who are no longer enrolled, the cumulative GPA from the last semester of enrollment is used. Spring 2002 is represented by “0”. Panel A limits the sample to students who initially enrolled in a senior college and Panel B limits the sample to students who initially enrolled in a community college. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Table 1: Characteristics of Students by Citizenship and Documentation Status at Entry

	2. Noncitizens		3. Tests of equality (<i>p</i> -value)			
	1. Citizens	(A) Documented	(B) Undocumented	Citizen vs. noncitizens	Documented vs. undoc.	All three groups
Age	19	20	20	<0.001	0.003	<0.001
Female	0.58	0.58	0.59	0.996	0.434	0.736
Race/ethnicity:						
Asian/Pacific Islander	0.08	0.25	0.21	<0.001	<0.001	<0.001
Black	0.30	0.29	0.36	0.281	<0.001	<0.001
Hispanic	0.33	0.28	0.29	<0.001	0.481	<0.001
White	0.29	0.18	0.14	<0.001	<0.001	<0.001
Single parent	0.03	0.03	0.02	0.293	0.755	0.564
Disabled	0.03	0.02	0.02	<0.001	0.272	<0.001
Foreign-born	0.08	1	1			
Permanent resident	--	0.92	--			
Visa-holder	--	0.08	--			
Refugee	--	0.002	--			
High school GPA (0-100)	76	77	77	<0.001	0.215	<0.001
Missing high school GPA	0.05	0.04	0.07	0.581	<0.001	<0.001
Need any remediation	0.51	0.60	0.60	<0.001	0.957	<0.001
Bachelor's degree program	0.37	0.36	0.28	<0.001	<0.001	<0.001
Initial institution selectivity:						
Very competitive	0.06	0.07	0.04	<0.001	<0.001	<0.001
Competitive	0.28	0.26	0.20	<0.001	<0.001	<0.001
Less/noncompetitive	0.26	0.24	0.23	<0.001	0.096	<0.001
Nonselective	0.40	0.43	0.52	<0.001	<0.001	<0.001
Observations	43,728	18,703	2,319			

Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. High school GPA refers to the CUNY college admissions average, which is a standardized measure of students' high school grade point averages on a scale of 0 to 100. College competitiveness level according to the Barron's Profile of American Colleges.

Table 2: The Impact of the Tuition Increase on Undocumented Students' Attainment

	(1) Pooled	(2) Senior College Students	(3) Community College Students
<i>A. Persistence</i>			
Undocumented × Spring 2002	-0.041 (0.010)**	-0.056 (0.012)**	-0.020 (0.015)
Undocumented × Post-Spring 2002	-0.029 (0.010)**	-0.028 (0.015)+	-0.017 (0.013)
Pre-Spring 2002 Undocumented Mean	0.74	0.78	0.70
Impact in % Change - Spring 2002	-6%	-7%	-3%
Impact in % Change - Post-Spring 2002	-4%	-4%	-2%
Observations	117,398	65,572	51,826
<i>B. Credits Earned</i>			
Undocumented × Spring 2002	-0.648 (0.095)**	-0.689 (0.135)**	-0.607 (0.143)**
Undocumented × Post-Spring 2002	-0.539 (0.100)**	-0.531 (0.147)**	-0.540 (0.137)**
Pre-Spring 2002 Undocumented Mean	7.0	8.1	6.0
Impact in % Change - Spring 2002	-9%	-9%	-10%
Impact in % Change - Post-Spring 2002	-8%	-7%	-9%
Observations	131,033	73,340	57,693
<i>C. Cumulative GPA</i>			
Undocumented × Spring 2002	-0.015 (0.014)	-0.004 (0.019)	-0.016 (0.022)
Undocumented × Post-Spring 2002	-0.006 (0.014)	-0.003 (0.018)	0.008 (0.020)
Pre-Spring 2002 Undocumented Mean	2.41	2.44	2.38
Impact in % Change - Spring 2002	-1%	-0.2%	-0.7%
Impact in % Change - Post-Spring 2002	-0.2%	-0.1%	0.3%
Observations	131,033	73,340	57,693

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** p<0.01, * p<0.05, + p<0.1. Reported coefficients are interactions between an indicator for whether a student is an undocumented noncitizen at college entry and Spring 2002 and undocumented status with post-Spring 2002. All regressions also include controls for age at entry, high school GPA (set to zero if missing), an indicator for whether a student's high school GPA is missing, indicators for race/ethnicity (Black, Hispanic, or White) and gender, an indicator for initial degree program (associate's versus bachelor's degree), indicators for whether the student was a single parent, needed remediation, or was disabled at entry, semesters since entry fixed effects, institution by cohort fixed effects, and indicators for whether a student is an undocumented noncitizen at entry, spring 2002, and post-spring 2002 semesters. The sample of senior college students includes those who initially enrolled in Baruch, Brooklyn, City, Hunter, John Jay, Queens, Lehman, City College of Technology, Staten Island, or York Colleges. The sample of community college students include those who initially enrolled in Borough of Manhattan, Bronx, Hostos, Kingsborough, LaGuardia, or Queensborough Community Colleges. Student by semester observations are dropped following degree receipt. Panel A regressions exclude observations of students in their first semester.

Table 3: The Impact of the Tuition Increase on Documented and Undocumented Students' Attainment

	(1) Pooled	(2) Senior College Students	(3) Community College Students
<i>A. Enrollment</i>			
Noncitizen × Spring 2002	-0.008 (0.007)	-0.002 (0.008)	-0.015 (0.008)+
× Undocumented	-0.039 (0.011)**	-0.055 (0.012)**	-0.019 (0.016)
Noncitizen × Post-Spring 2002	-0.012 (0.012)	-0.009 (0.013)	-0.012 (0.016)
× Undocumented	-0.028 (0.010)**	-0.028 (0.015)+	-0.016 (0.013)
Observations	360,468	211,978	148,490
<i>B. Credits Attempted</i>			
Noncitizen × Spring 2002	-0.052 (0.080)	-0.099 (0.094)	0.010 (0.118)
× Undocumented	-0.641 (0.096)**	-0.688 (0.135)**	-0.605 (0.144)**
Noncitizen × Post-Spring 2002	-0.096 (0.126)	-0.156 (0.152)	-0.012 (0.175)
× Undocumented	-0.534 (0.101)**	-0.530 (0.148)**	-0.538 (0.138)**
Observations	403,304	237,570	165,734
<i>C. Cumulative GPA</i>			
Noncitizen × Spring 2002	-0.021 (0.018)	-0.013 (0.025)	-0.027 (0.015)+
× Undocumented	-0.014 (0.014)	-0.006 (0.020)	-0.014 (0.022)
Noncitizen × Post-Spring 2002	-0.013 (0.032)	0.002 (0.043)	-0.027 (0.026)
× Undocumented	-0.006 (0.014)	-0.005 (0.019)	0.010 (0.020)
Observations	403,304	237,570	165,734

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Table 2 notes for additional control variables and definitions of senior and community college samples. All regressions also control for citizenship and interactions between indicators for spring 2002 and post-spring 2002 with citizenship. Student by semester observations are dropped following degree receipt. Panel A regressions exclude observations of students in their first semester.

Table 4: Robustness of Estimated Impacts on Enrollment

	(1) Student Fixed Effects	(2) Conditioning on enrollment t-1	(3) Larger window (+/- 4 sem)	(4) Smaller window (+/- 2 sem)
<i>A. Senior College Students</i>				
Undocumented × Spring 2002	-0.037 (0.016)*	-0.060 (0.012)**	-0.057 (0.012)**	-0.050 (0.011)**
Undocumented × Post-Spring 2002	-0.009 (0.016)	-0.039 (0.015)*	-0.025 (0.015)+	-0.025 (0.015)
Pre-Spring 2002 Undocumented Mean	0.78	0.97	0.80	0.77
Impact in % Change - Spring 2002	-5%	-6%	-7%	-6%
Impact in % Change - Post-Spring 2002	-1%	-4%	-3%	-3%
Observations	65,572	52,209	79,767	50,233
<i>B. Community College Students</i>				
Undocumented × Spring 2002	-0.017 (0.017)	-0.043 (0.018)*	-0.015 (0.015)	-0.006 (0.016)
Undocumented × Post-Spring 2002	-0.014 (0.016)	-0.034 (0.013)*	-0.004 (0.013)	-0.003 (0.015)
Pre-Spring 2002 Undocumented Mean	0.70	0.96	0.72	0.68
Impact in % Change - Spring 2002	-2%	-4%	-2%	-1%
Impact in % Change - Post-Spring 2002	-2%	-4%	-1%	0%
Observations	51,826	36,184	63,146	39,504

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Table 2 notes for additional control variables and definitions of senior and community college samples. Student fixed effects models also include student fixed effects. The column (2) sample is limited to students who were enrolled in the fall 2001 semester. The column (3) sample includes student by semester observations from four semesters before and after the policy change while the column (4) sample excludes student by semester observations more than two semesters before/after the policy change. Student by semester observations are dropped following degree receipt. Observations of students in their first semester are excluded.

Table 5: Robustness of Estimated Impacts on Credits Earned

	(1) Student Fixed Effects	(2) Conditioning on enrollment t-1	(3) Larger window (+/- 4 sem)	(4) Smaller window (+/- 2 sem)
<i>A. Senior College Students</i>				
Undocumented × Spring 2002	-0.630 (0.166)**	-0.775 (0.171)**	-0.679 (0.142)**	-0.672 (0.137)**
Undocumented × Post-Spring 2002	-0.490 (0.169)**	-0.665 (0.173)**	-0.420 (0.153)**	-0.566 (0.150)**
Pre-Spring 2002 Undocumented Mean	8.1	9.9	8.1	8.1
Impact in % Change - Spring 2002	-8%	-8%	-8%	-8%
Impact in % Change - Post-Spring 2002	-6%	-7%	-5%	-7%
Observations	73,340	59,235	88,060	54,369
<i>B. Community College Students</i>				
Undocumented × Spring 2002	-0.661 (0.160)**	-0.813 (0.183)**	-0.604 (0.143)**	-0.462 (0.161)**
Undocumented × Post-Spring 2002	-0.592 (0.165)**	-0.763 (0.180)**	-0.440 (0.127)**	-0.342 (0.154)*
Pre-Spring 2002 Undocumented Mean	6.0	7.8	6.0	5.8
Impact in % Change - Spring 2002	-11%	-10%	-10%	-8%
Impact in % Change - Post-Spring 2002	-10%	-10%	-7%	-6%
Observations	57,693	41,111	69,809	42,914

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Table 4 notes for description of specifications. Student by semester observations are dropped following degree receipt.

Table 6: Heterogeneity in the Impact of the Tuition Increase by Gender

	(1) Senior College Students		(2) Community College Students	
	Female	Male	Female	Male
<i>A. Enrollment</i>				
Undocumented × Spring 2002	-0.059 (0.017)**	-0.049 (0.016)**	0.002 (0.019)	-0.052 (0.023)*
Test of equality (<i>p</i> -value)	[0.655]		[0.059]	
Undocumented × Post-Spring 2002	-0.026 (0.019)	-0.031 (0.020)	0.006 (0.016)	-0.048 (0.023)*
Test of equality (<i>p</i> -value)	[0.853]		[0.079]	
Observations	65,572		51,826	
<i>B. Credits Earned</i>				
Undocumented × Spring 2002	-0.868 (0.185)**	-0.434 (0.250)+	-0.521 (0.175)**	-0.731 (0.245)**
Test of equality (<i>p</i> -value)	[0.202]		[0.494]	
Undocumented × Post-Spring 2002	-0.554 (0.173)**	-0.508 (0.219)*	-0.506 (0.197)*	-0.580 (0.228)*
Test of equality (<i>p</i> -value)	[0.854]		[0.820]	
Observations	73,340		57,693	
<i>C. Cumulative GPA</i>				
Undocumented × Spring 2002	0.002 (0.027)	-0.011 (0.029)	-0.001 (0.023)	-0.038 (0.029)
Test of equality (<i>p</i> -value)	[0.762]		[0.187]	
Undocumented × Post-Spring 2002	-0.006 (0.023)	0.001 (0.026)	0.031 (0.022)	-0.025 (0.021)
Test of equality (<i>p</i> -value)	[0.835]		[0.008]	
Observations	73,340		57,693	

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Brackets contain *p*-values from test of equality of treatment variables by gender. See Table 2 notes for description of control variables and specification. All control variables are fully interacted with gender indicator variables. Panel A regressions exclude observations of students in their first semester.

Table 7: Heterogeneity in the Impact of the Tuition Increase by Race/Ethnicity

	<u>(1) Senior College Students</u>				<u>(2) Community College Students</u>			
	Asian	Black	Hisp.	White	Asian	Black	Hisp.	White
<i>A. Enrollment</i>								
Undocumented × Spring 2002	-0.066 (0.021)**	-0.040 (0.022)+	-0.083 (0.023)**	-0.031 (0.032)	0.004 (0.027)	-0.002 (0.024)	-0.028 (0.028)	-0.079 (0.037)*
Test of equality (<i>p</i> -value)	[0.552]				[0.265]			
Undocumented × Post-Spring 2002	-0.011 (0.023)	-0.019 (0.026)	-0.020 (0.031)	-0.051 (0.035)	-0.014 (0.037)	0.001 (0.026)	-0.015 (0.025)	-0.061 (0.033)+
Test of equality (<i>p</i> -value)	[0.772]				[0.524]			
Observations	65,518				51,723			
<i>B. Credits Attempted</i>								
Undocumented × Spring 2002	-0.464 (0.286)	-0.567 (0.223)*	-1.167 (0.287)**	-0.334 (0.338)	-0.521 (0.369)	-0.321 (0.210)	-0.890 (0.283)**	-0.627 (0.388)
Test of equality (<i>p</i> -value)	[0.294]				[0.519]			
Undocumented × Post-Spring 2002	-0.595 (0.244)*	-0.375 (0.232)	-0.740 (0.354)*	-0.225 (0.363)	-0.339 (0.320)	-0.288 (0.248)	-0.918 (0.192)**	-0.202 (0.380)
Test of equality (<i>p</i> -value)	[0.764]				[0.195]			
Observations	73,283				57,580			
<i>C. Cumulative GPA</i>								
Undocumented × Spring 2002	0.026 (0.030)	0.007 (0.024)	-0.002 (0.039)	-0.021 (0.043)	-0.028 (0.052)	-0.012 (0.024)	-0.012 (0.038)	-0.035 (0.039)
Test of equality (<i>p</i> -value)	[0.829]				[0.902]			
Undocumented × Post-Spring 2002	-0.001 (0.029)	0.010 (0.027)	0.038 (0.039)	-0.014 (0.043)	0.000 (0.042)	0.027 (0.027)	-0.022 (0.033)	0.023 (0.058)
Test of equality (<i>p</i> -value)	[0.822]				[0.754]			
Observations	73,283				57,580			

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2002 entering cohorts. Students classified as Native American are dropped. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Brackets contain *p*-values from test of equality of treatment variables by race/ethnicity categories. See Table 2 notes for description of control variables and specification. All control variables are fully interacted with indicators for race/ethnicity. Panel A regressions exclude observations of students in their first semester.

Table 8: Impacts of the Tuition Increase on Cumulative Credits and Degree Receipt

	1. Cumulative	Degree within four years			Degree within eight years		
	credits	2. Any	3. AA/AS	4. BA/BS	5. Any	6. AA/AS	7. BA/BS
<i>A. All Students</i>							
Undocumented × Pre-Spring 2002	-6.071 (2.274)**	-0.021 (0.024)	-0.014 (0.022)	-0.007 (0.013)	-0.081 (0.029)**	-0.030 (0.026)	-0.051 (0.025)*
Post-Spring 2002 Undocumented mean	64.6	0.21	0.15	0.06	0.43	0.17	0.27
Impact in % change	-9%	-10%	-9%	-12%	-19%	-18%	-19%
Observations	39,536	39,536	39,536	39,536	39,536	39,536	39,536
<i>B. Senior College Students</i>							
Undocumented × Pre-Spring 2002	-8.48 (3.09)**	-0.051 (0.029)+	-0.041 (0.021)+	-0.010 (0.023)	-0.134 (0.043)**	-0.066 (0.030)*	-0.068 (0.044)
Post-Spring 2002 Undocumented mean	78.2	0.18	0.05	0.13	0.51	0.07	0.44
Impact in % change	-11%	-28%	-82%	-8%	-26%	-94%	-15%
Observations	22,319	22,319	22,319	22,319	22,319	22,319	22,319
<i>C. Community College Students</i>							
Undocumented × Pre-Spring 2002	-3.41 (3.26)	0.013 (0.035)	0.018 (0.036)	-0.005 (0.008)	-0.022 (0.032)	0.012 (0.036)	-0.034 (0.025)
Post-Spring 2002 Undocumented mean	51.8	0.23	0.21	0.01	0.36	0.22	0.14
Impact in % change	-7%	6%	9%	-50%	-6%	5%	-24%
Observations	17,217	17,217	17,217	17,217	17,217	17,217	17,217

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 or Fall 2002 through Fall 2005 entering cohorts. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** p<0.01, * p<0.05, + p<0.1. Reported coefficients are interactions between an indicator for whether a student is an undocumented noncitizen at college entry and belonging to a pre-Spring 2002 entry cohort. All regressions also include controls for age at entry, high school GPA (set to zero if missing), an indicator for whether a student's high school GPA is missing, indicators for race/ethnicity (Black, Hispanic, or White) and gender, an indicator for initial degree program (associate's versus bachelor's degree), indicators for whether the student was a single parent, needed remediation, or was disabled at entry, institution by cohort fixed effects, cohort-specific time trends (allowed to vary by documentation status), and indicators for whether a student is an undocumented noncitizen at entry and belonging to a pre-Spring 2002. The sample of senior college students includes those who initially enrolled in Baruch, Brooklyn, City, Hunter, John Jay, Queens, Lehman, City College of Technology, Staten Island, or York Colleges. The sample of community college students include those who initially enrolled in Borough of Manhattan, Bronx, Hostos, Kingsborough, LaGuardia, or Queensborough Community Colleges.

Appendix A: Additional Figures and Tables

Table A.1: Characteristics of Students by Citizenship and Documentation Status at Entry: Senior College Students

	2. Noncitizens		3. Tests of equality (p -value)			
	1. Citizens	(A) Documented	(B) Undocumented	Citizen vs. noncitizens	Documented vs. undoc.	All three groups
Age	19	19	19	<0.001	0.043	<0.001
Female	0.58	0.57	0.59	0.347	0.213	0.295
Race/ethnicity:						
Asian/Pacific Islander	0.10	0.29	0.24	<0.001	<0.001	<0.001
Black	0.28	0.28	0.37	0.126	<0.001	<0.001
Hispanic	0.29	0.21	0.24	<0.001	0.017	<0.001
White	0.33	0.22	0.15	<0.001	<0.001	<0.001
Single parent	0.02	0.01	0.01	0.350	0.890	0.641
Disabled	0.03	0.01	0.01	<0.001	0.457	<0.001
Need any remediation	0.34	0.42	0.40	<0.001	0.157	<0.001
Bachelor's degree program	0.61	0.64	0.60	<0.001	0.011	<0.001
Foreign-born	0.08	1	1			
Citizen	1	--	--			
Permanent resident	--	0.92	--			
Visa-holder	--	0.08	--			
Refugee	--	0.002	--			
High school GPA (0-100)	78	80	80	<0.001	0.816	<0.001
Missing high school GPA	0.02	0.02	0.04	0.938	<0.001	<0.001
Initial institution selectivity:						
Very competitive	0.09	0.12	0.09	<0.001	0.002	<0.001
Competitive	0.47	0.45	0.43	<0.001	0.236	<0.001
Less/noncompetitive	0.44	0.43	0.48	0.460	0.001	0.004
Observations	26,391	10,640	1,102			

Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who initially enrolled in a senior college. See Table 1 notes for additional details.

Table A.2: Characteristics of Students by Citizenship and Documentation Status at Entry: Community College Students

	2. Noncitizens		3. Tests of equality (p -value)			
	1. Citizens	(A) Documented	(B) Undocumented	Citizen vs. noncitizens	Documented vs. undoc.	All three groups
Age	21	21	21	<0.001	0.858	<0.001
Female	0.59	0.59	0.59	0.374	0.716	0.630
Race/ethnicity:						
Asian/Pacific Islander	0.06	0.19	0.19	<0.001	0.968	<0.001
Black	0.33	0.30	0.35	<0.001	0.002	<0.001
Hispanic	0.39	0.37	0.33	<0.001	0.003	<0.001
White	0.22	0.13	0.13	<0.001	0.965	<0.001
Single parent	0.04	0.04	0.03	0.077	0.222	0.105
Disabled	0.04	0.02	0.02	<0.001	0.700	<0.001
Need any remediation	0.76	0.83	0.78	<0.001	<0.001	<0.001
Foreign-born	0.09	1	1			
Citizen	1	--	--			
Permanent resident	--	0.92	--			
Visa-holder	--	0.08	--			
Refugee	--	0.002	--			
High school GPA (0-100)	72	74	74	<0.001	<0.001	<0.001
Missing high school GPA	0.08	0.06	0.10	0.023	<0.001	<0.001
Observations	17,337	8,063	1,217			

Source: CUNY administrative data. Notes: Sample includes first-time CUNY degree-seeking undergraduate students belonging to the Fall 1999 through Fall 2002 entering cohorts who initially enrolled in a community college. See Table 1 notes for additional details.

Table A.3: Heterogeneity in the Impact of the Tuition Increase on Attainment by Initial Degree Program: Senior College Students

	(1) BA Degree	(2) AA Degree
<i>A. Enrollment</i>		
Undocumented × Spring 2002	-0.060 (0.014)**	-0.046 (0.019)*
Test of equality (<i>p</i> -value)		[0.528]
Undocumented × Post-Spring 2002	-0.042 (0.018)*	-0.001 (0.025)
Test of equality (<i>p</i> -value)		[0.172]
Pre-Spring 2002 Undocumented Mean	0.84	0.69
Impact in % Change - Spring 2002	-0.07	-0.07
Impact in % Change - Post-Spring 2002	-0.05	-0.001
Observations	41,358	24,214
<i>B. Credits Earned</i>		
Undocumented × Spring 2002	-0.699 (0.182)**	-0.662 (0.201)**
Test of equality (<i>p</i> -value)		[0.891]
Undocumented × Post-Spring 2002	-0.502 (0.183)**	-0.498 (0.241)+
Test of equality (<i>p</i> -value)		[0.991]
Pre-Spring 2002 Undocumented Mean	9.5	6.1
Impact in % Change - Spring 2002	-0.07	-0.11
Impact in % Change - Post-Spring 2002	-0.05	-0.08
Observations	46,376	26,964
<i>C. Cumulative GPA</i>		
Undocumented × Spring 2002	-0.005 (0.022)	-0.009 (0.029)
Test of equality (<i>p</i> -value)		[0.919]
Undocumented × Post-Spring 2002	-0.009 (0.021)	-0.001 (0.030)
Test of equality (<i>p</i> -value)		[0.822]
Pre-Spring 2002 Undocumented Mean	2.56	2.26
Impact in % Change - Spring 2002	-0.002	-0.004
Impact in % Change - Post-Spring 2002	-0.004	-0.0004
Observations	46,376	26,964

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students from New York belonging to the Fall 1999 through Fall 2002 entering cohorts who initially enrolled in Baruch, Brooklyn, City, Hunter, John Jay, Queens, Lehman, City College of Technology, Staten Island, or York Colleges. Each column within a panel represents a separate regression. Clustered standard errors (institution by cohort) in parentheses; ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Reported coefficients are interactions between an indicator for whether a student is an undocumented noncitizen at college entry and Spring 2002 and undocumented status with post-Spring 2002. See Table 2 notes for additional details.

Table A.4: Robustness of Estimated Impacts on Cumulative GPA

	(1) Student Fixed Effects	(2) Conditioning on enrollment t-1	(3) Larger window (+/- 4 sem)	(4) Smaller window (+/- 2 sem)
<i>A. Senior College Students</i>				
Undocumented × Spring 2002	-0.002 (0.015)	-0.015 (0.024)	0.004 (0.022)	-0.008 (0.017)
Undocumented × Post-Spring 2002	-0.005 (0.017)	-0.002 (0.022)	0.012 (0.021)	-0.010 (0.015)
Pre-Spring 2002 Undocumented Mean	2.44	2.63	2.43	2.43
Impact in % Change - Spring 2002	-0.1%	-1%	0.2%	-0.3%
Impact in % Change - Post-Spring 2002	-0.2%	-0.1%	0.5%	-0.4%
Observations	73,340	59,235	88,060	54,369
<i>B. Community College Students</i>				
Undocumented × Spring 2002	-0.012 (0.015)	-0.001 (0.026)	-0.018 (0.024)	-0.009 (0.020)
Undocumented × Post-Spring 2002	0.018 (0.018)	0.024 (0.022)	0.008 (0.021)	0.014 (0.018)
Pre-Spring 2002 Undocumented Mean	2.38	2.54	2.39	2.35
Impact in % Change - Spring 2002	-1%	-0.04%	-1%	-0.4%
Impact in % Change - Post-Spring 2002	1%	1%	0.3%	1%
Observations	57,693	41,111	69,809	42,914

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking undergraduate students from New York belonging to the Fall 1999 through Fall 2002 entering cohorts. See Table 2 notes for additional details.

Table A.5: Heterogeneity in the Impacts of the Tuition Increase on Cumulative Credits and Degree Receipt: Senior College Students

	1. Cumulative	<u>Degree within four years</u>			<u>Degree within eight years</u>		
	credits	2. Any	3. AA	4. BA	5. Any	6. AA	7. BA
<i>A. BA-degree seeking students</i>							
Undocumented × Pre-Spring 2002	-10.52 (4.183)*	-0.031 (0.039)	-0.019 (0.020)	-0.012 (0.033)	-0.134 (0.060)*	-0.013 (0.023)	-0.121 (0.057)*
Post-Spring 2002 Undocumented mean	88.3	0.18	0.02	0.16	0.57	0.04	0.53
Impact in % change	-0.12	-0.17	-0.95	-0.08	-0.24	-0.33	-0.23
Observations	14,413	14,413	14,413	14,413	14,413	14,413	14,413
<i>B. AA-degree seeking students</i>							
Undocumented × Pre-Spring 2002	-4.75 (3.79)	-0.069 (0.052)	-0.064 (0.053)	-0.005 (0.021)	-0.121 (0.047)*	-0.134 (0.041)**	0.013 (0.042)
Post-Spring 2002 Undocumented mean	61.0	0.15	0.11	0.04	0.37	0.15	0.22
Impact in % change	-0.08	-0.46	-0.58	-0.13	-0.33	-0.89	0.06
Observations	7,906	7,906	7,906	7,906	7,906	7,906	7,906

Source: CUNY administrative data. *Notes:* Sample includes first-time CUNY degree-seeking noncitizen undergraduate students from New York belonging to the Fall 1999 through Fall 2001 or Fall 2002 through Fall 2005 entering cohorts. Each column within a panel represents a separate regression. See Table 8 notes for additional details.