# The Effect of Price Shocks on Undocumented Students' College Attainment and Completion*

Dylan Conger† Lesley J. Turner‡

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**Abstract**

We examine the effect of a price shock caused by the temporary removal of in-state tuition benefits on the attainment of undocumented immigrants enrolled in a large urban college system using a difference-in-differences identification strategy. The 113 percent one-semester tuition increase led to an 8 percent decrease in reenrollment and a similarly-sized reduction in credit accumulation. Furthermore, students who entered college the semester prior to the price shock experienced lasting reductions in attainment, including a 22 percent decrease in degree receipt. Conversely, among students who been enrolled for at least a year, the price shock only affected the timing of college exit. Our results suggest that public subsidies that lower college prices can increase degree completion among resource-constrained students who have made the decision to enroll in college, with larger benefits accruing to those who are early in their college careers. *Keywords: educational attainment; higher education; undocumented immigrants; tuition subsidy. JEL: I21, I22, H75, J15*

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†George Washington University Trachtenberg School of Public Policy and Public Administration, 805 21st Street NW, Washington, DC 20052. dconger@gwu.edu. Phone: 202-994-1456. Fax: 202-994-6792.

‡University of Maryland – College Park Department of Economics and NBER; 3114 Tydings Hall, College Park, MD 20742, turner@econ.umd.edu.

# 1 Introduction

In the absence of federal policy governing access to higher education for the nation's 11 million undocumented immigrants, many states have chosen to invest in their integration by extending eligibility for in-state higher education tuition benefits. Previous research suggests that such subsidies increase undocumented students' college enrollment, yet little is known about whether these public expenditures increase college completion and degree receipt. This same information gap exists in research on the effects of college prices for the general student population; while many studies demonstrate that changes in price affect college enrollment (e.g., Deming and Dynarski, 2010), only a handful of papers investigate price effects on persistence and degree receipt. Despite the growth in college enrollment, college completion rates have declined, particularly among low-income students (Bound, Lovenheim and Turner, 2010; Bailey and Dynarski, 2011), underscoring the importance of research on the long-run effects of public and institutional investments aimed at lowering higher education costs.

In this paper, we estimate the effect of a one-semester price increase on undocumented students' reenrollment, credits, grades, and degree receipt. We identify these effects using the unanticipated elimination and subsequent restoration of the in-state tuition subsidy for undocumented students enrolled in New York City's public university system, the City University of New York (CUNY). Midway through the fall of 2001, CUNY reversed its long-standing policy of charging in-state tuition rates to undocumented students from New York. As a result, undocumented students were exposed to a significant increase in tuition for the following semester, with students enrolled in one of CUNY's "senior" colleges (institutions that offer both bachelor's and associate's degrees) facing a 113 percent price increase.[1] The price hike was reversed after a single semester, which renders our variation much like public, private, and institutional policies that change tuition prices and financial aid offerings from year to year.[2]

To identify the impact of the price shock on short-run attainment, we use a generalized difference-in-differences identification strategy that compares changes in undocumented students' outcomes three semesters before and after the tuition hike to differences in the outcomes of documented noncitizens, a group unaffected by the policy change.[3] The price hike led to an immediate 8 percent reduction in reenrollment

[1] Though postsecondary institutions are typically classified as "four-year" or "two-year", we use the CUNY System's label of "senior" college (as opposed to "four-year" college) because approximately 40 percent of CUNY's senior college students start out in an associate's degree program and these students face the same tuition charges as senior college students 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

[2] Undocumented students in CUNY's community colleges also faced a price increase of roughly 23 percent in spring 2002. We find no evidence of statistically significant responses to this modest price hike among undocumented community college students. However, given the size of the tuition shock and the small number of undocumented community college students, our estimates are highly imprecise and prevent us from drawing meaningful conclusions. Results pertaining to community college students are available upon request.

[3] The majority (93 percent) of documented noncitizens are permanent residents.

and a similar decrease in credit accumulation. However, we estimate that over half of the undocumented students induced to exit college by the price shock would have dropped-out in future semesters, even in the absence of a price increase. Inframarginal exits occur primarily among students who had spent at least one year in college before the price increase. Conversely, among students who entered college the semester before the policy change, the price shock primarily reduced reenrollment of marginal students - those who would have otherwise persisted in college.

To evaluate the effect of the price shock on long-run outcomes, we take advantage of its heterogeneous impacts across entry cohorts. Among students who had been enrolled for at least two years prior to the shock, the tuition increase only affected the timing of college exit, but not the overall probability of exit. Thus, these students serve as a comparison group for undocumented students in later entry cohorts and we compare their credit accumulation and degree receipt eight years after entry with the outcomes of later entry cohorts, again using differences in documented noncitizens' outcomes across entry cohorts to generate a counterfactual. Undocumented students exposed to the price shock earlier in their college careers experienced the largest decrease in long-run attainment. Among students who first enrolled the semester prior to the price shock, degree receipt fell by 22 percent, while students with at least one year of enrollment prior to the shock saw a 6 percent reduction in degree receipt. One explanation for this finding is that as students gain more experience in college, they are better able to predict their long-run success. As a result, price shocks close to college entry are more likely to induce dropout among marginal students who would have ultimately been successful.

Our findings directly contribute to research examining the effect of state, local, and institutional policies aimed at making college more accessible to undocumented students. Undocumented youth who migrate to the US as children are a centerpiece of federal immigration reform proposals and recent higher education policies in many states. Although federal efforts to pass legislation extending legal status and other federal benefits to this population have been unsuccessful, 18 states now provide in-state tuition benefits to undocumented youth who received their secondary schooling in the state. These subsidies represent a substantial reduction in postsecondary costs given that out-of-state tuition rates are typically more than twice the in-state rates (Hemelt and Marcotte, 2011).

In addition to informing the debate over policies targeting undocumented youth, our focus on undocumented college students provides an additional advantage for estimating the effects of college prices on attainment. For most college students, exogenous variation in college prices may be offset by endogenous responses on the part of students or institutions, which muddies attempts to identify price elasticities of enrollment or degree receipt (e.g., Turner, 2014; Marx and Turner, 2015). In contrast, undocumented students lack access to public grant and loan programs, making it difficult for them to offset changes in tuition

through increases in financial aid. These conditions allow for more accurate estimates of the price elasticity of college enrollment and attainment than estimates generated from a population with access to other sources of financial aid.

Several existing studies use national survey data and a difference-in-differences framework to estimate the effects of in-state tuition subsidies on undocumented students' college enrollment decisions. Kaushal (2008), Chin and Juhn (2011), and Darolia and Potochnick (2014) estimate the average effects of in-state tuition across all states with such policies, while Flores (2010) focuses on the impact of Texas' in-state tuition subsidy. All four 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. Three of the four studies find positive impacts of eligibility for the in-state tuition subsidy on college enrollment (Kaushal, 2008; Flores, 2010; Darolia and Potochnick, 2014). Our study builds on this prior work by estimating the effect of such subsidies on enrolled students' retention, credits, grades, and ultimate degree receipt. In addition to informing sub-national policies, evaluations of price effects on degree attainment can inform federal immigration reform proposals aimed at providing undocumented youth with a pathway to citizenship through college attendance and completion.

Our findings are clearly best generalized to the undocumented college population, but our setting also provides a unique opportunity to better understand the effect of postsecondary prices on the human capital acquisition of low-income students in the general population. Research reviewed by Deming and Dynarski (2010) points to significant increases in college-going among students who experience a policy-driven price decrease. However, there is far less evidence on the impact of price changes on the postsecondary attainment of students after they have already spent time in college. Although gaps in college entry by family income have shrunk in recent years, low-income students' graduation rates remain low (Bailey and Dynarski, 2011), suggesting that the effects of financial need on attainment persist beyond the enrollment margin. A handful of studies suggest that increases in need-based grants can boost the attainment of enrolled students when such increases are not offset by reductions in other aid (Bettinger, 2004; Angrist et al., 2014; Goldrick-Rab et al., 2015; Marx and Turner, 2015).[4] A related body of research explores the role of monetary incentives

[4]Goldrick-Rab et al. (2015) find that eligibility for an annual $3,500 Wisconsin Scholars Grant increased four-year bachelor's degree completion by 5 percentage points (21 percent). Illustrating the importance of accounting for loan crowd-out, Marx and Turner (2015) estimate that Pell Grant aid does not increase persistence or attainment in a setting where additional grant aid reduces aid from federal loans. In contrast, Bettinger (2004) provides evidence that Pell Grant aid increases Ohio public college students' persistence rates between the first to the second year of college, with an additional $1,000 in Pell Grant aid estimated to increase reenrollment by 3 to 4 percentage points. However, these estimates are not robust to controlling for institution fixed-effects. Castleman and Long (2013) estimate the impact of state need-based grant aid on Florida high school graduates' college enrollment and attainment and impacts on both initial enrollment and degree receipt. However, the positive effect of grant eligibility on enrollment makes it is difficult to determine whether grant aid eligibility increased attainment above and beyond its impacts on college attendance. Addressing concerns of both selection into college and crowd-out of federal and institutional grant aid, Angrist et al. (2014) examine the impact of a need- and merit-based scholarship in Nebraska. They find substantial impacts on the persistence of nonwhite students, but estimate that overall, at least 80 percent of funds were spent on students whose behavior was not affected by the grant.

tied to other supports (such as mentors) or requirements (such as a minimum course load or grade point average) on enrolled students' effort and degree completion (Dynarski, 2008; Angrist, Lang and Oreopoulos, 2009; Scott-Clayton, 2011; Patel and Rudd, 2012; Angrist, Oreopoulos and Williams, 2014; Barrow et al., 2014). Although most studies examining student incentives in higher education find positive impacts on enrolled students' attainment, in these cases, assistance is based on student performance and often involves both monetary and additional supports.[5] Our study focuses exclusively on the estimation of tuition price effects. We also estimate both short- and long-run effects of a price shock, focusing on semester to semester reenrollment as well as credit accumulation and degree receipt. Finally, ours is the first study providing evidence that students early in their college careers are more vulnerable to price shocks than students with more college experience.

The remainder of this paper proceeds as follows: in Section 2, we describe the CUNY System and provide background information on 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 semesters that immediately follow. 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). In fall 2013, approximately 8,300 undocumented students were enrolled in New York state colleges, with 80 percent residing in New York City and attending one of the CUNY System schools (DiNapoli and Bleiwas, 2014).[6]

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

[5] 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' grade point average and persistence(Angrist, Lang and Oreopoulos, 2009). However, a follow-up study that involved stronger incentives found smaller impacts on attainment (Angrist, Oreopoulos and Williams, 2014). Finally, a series of papers examine the impact of randomly assigned student incentives and find evidence of small, but significant impacts on attainment (e.g., Patel and Rudd, 2012; Barrow et al., 2014).

[6] An additional 18 percent of undocumented students were enrolled in a SUNY institution in one of the five counties surrounding New York City, and the remaining 2 percent attended a SUNY institution elsewhere in the state.

programs.[7] Additionally, CUNY senior college students who are enrolled in an associate's degree program face the same tuition rates as those in a bachelor's degree program. In 2001, nominal in-state tuition for a full-time senior college student was $3,200 per year, while the nominal out-of-state rate faced for full-time senior college students was $6,800.[8]

Our identification strategy takes advantage of two unanticipated shocks to undocumented senior college students' eligibility for in-state tuition. In 1989, long before any state considered granting in-state tuition to undocumented students, New York City Mayor Edward Koch issued an executive order that extended in-state prices 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 (Rincón, 2008). Yet in the fall of 2001, shortly after the terrorist attacks of September 11, the CUNY Chancellor overturned this policy and announced that starting in the spring 2002 semester, CUNY would charge undocumented students who had previously qualified for the in-state subsidy out-of-state tuition rates.[9] Although no changes to the new pricing policy were anticipated at the beginning of the spring 2002 semester, Governor George Pataki announced his support for legislation offering in-state tuition to undocumented students with ties to New York State in April 2002.[10] In the summer of 2002, the state legislature passed a law that restored in-state tuition benefits for eligible undocumented students. Thus, for the spring 2002 semester only, tuition rates for undocumented students at senior colleges more than doubled (from $133 to $283 per credit). With a full-course load of 12 credits, this represented a price increase of $1,800 for the semester.

## 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). The proposed *Development, Relief, and Education for Alien Minors* (DREAM) Act would provide eligible youth with a pathway to permanent residency status and access to federal benefits, such as aid for college.[11] Congress voted against the DREAM Act in 2001, 2007 and 2010. In an effort to jump-start reforms targeting undoc-

[7] This practice is not unique to the CUNY System. According to data from the Integrated Postsecondary Education Data System (IPEDS), in 2013, 60 percent of public institutions categorized as "four-year" schools also offered certificate or associate's degree programs.

[8] Both in-state and out-of-state tuition rates remained constant (in nominal terms) between fall 1999 and spring 2003. In-state rates increased to $4,000 per year for senior college students in fall 2003. Out-of-state rates increased to $8,640 per year for senior college students in fall 2003.

[9] See, for instance, Karen W. Arenson's 2001 *New York Times* article, "CUNY raises tuition rates for foreigners here illegally." Downloaded on 2/2/2014 from http://www.nytimes.com/2001/11/03/nyregion/cuny-raises-tuition-rates-for-foreigners-here-illegally.html.

[10] See Joyce Purnick's *New York Times* article, "Metro Matters; Tuition, Out of State And Beyond," (downloaded 1/5/2015 from http://www.nytimes.com/2002/02/18/nyregion/metro-matters-tuition-out-of-state-and-beyond.html) and Sara Hebel's May 2002 *Chronicle of Higher Education* article, "N.Y. Governor Backs Plan to Help Some Illegal Immigrants."

[11] In 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 degree.

umented youth, in 2012, the Obama administration announced the *Deferred Action for Childhood Arrivals* (DACA) program - an executive order that shields eligible undocumented immigrants from deportation and provides them with temporary work authorization. President Obama attempted to expand the DACA program to other undocumented residents in November 2014; however, a federal court order has suspended that action. In the meantime, several states, Boards of Regents, and individual institutions have opted to extend in-state tuition benefits to undocumented college students enrolled in public institutions. As of 2014, most of the top immigrant-receiving states (including California, New York, Texas, Florida, New Jersey, and Illinois) have granted the subsidy to eligible undocumented youth.

Despite the ample policy attention given to undocumented college students, there are few large-scale analyses of their outcomes because federally-sponsored surveys and other administrative data sources are prohibited from asking respondents to state their immigration status. Several qualitative studies of undocumented college students identified through non-probabilistic sampling methods find that students who lack documentation face substantial barriers to college success (Abrego, 2006; Contreras, 2009; Perez, 2009; Gonzales, 2011; Muñoz and Maldonado, 2012). 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 encountered 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 on and off campus (Contreras, 2009; Muñoz and Maldonado, 2012).

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) show that undocumented CUNY students' academic outcomes resemble those of other noncitizen immigrant groups (namely permanent residents and visa holders), all of whom earn higher GPAs and complete more credits than US citizens. These findings are in line with research on immigrant students in the K-12 education 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 are less able to compensate for tuition increases with anything other than employment in the informal labor market or loans from family members or other informal sources. Following the news that tuition will increase in the next semester, we predict that some undocumented students will exit college, reduce their credit-load, and/or devote less time to their school work. These negative impacts may continue in later semesters even when the in-state rates are restored if

students face costs associated with switching between working and attending college or expect to face other tuition increases in the future.[12]

# 3 Data and Sample

Our analyses rely on administrative data from the CUNY System, which includes information on first-time, degree-seeking students' demographic characteristics and academic outcomes. Crucially, CUNY records students' citizenship and immigration status 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.[13] Students must submit documentation to validate their self-reported status and those who either report that they are undocumented or who fail to provide documentation (e.g., current visa, temporary authorizations to live and work in the US) are recorded as undocumented. 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 the state of New York, either from a New York high school or GED program.

Our main sample consists of the 9,795 noncitizen students who obtained a high school diploma or GED from New York State and entered a senior college between fall 1999 and fall 2001.[14] The characteristics of these students and the corresponding set of 25,999 citizens who earned a high school degree or GED from New York State and entered a senior college between fall 1999 and fall 2001 are displayed in the first three columns of Table 1. Of the 35,794 students in these entry cohorts, 27 percent are noncitizens and 9 percent of the noncitizens are undocumented.

[12]While 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).

[13]A 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 a 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 the 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.

[14]Unfortunately, data from earlier entry cohorts are not available. Among the 45,317 degree-seeking senior college students in these entry cohorts, we drop 3,038 (7 percent) with missing citizenship or documentation information and an additional 282 (less than 1 percent) missing age at entry. Of the remaining 41,997 students in our sample, 29,499 are citizens, 11,480 are documented noncitizens, and the remaining 1,018 are undocumented. Restricting our sample to students who earned their high school diploma or GED in New York State excludes 142 undocumented students (14 percent) and 2,561 documented noncitizens (22 percent). We impose this restriction to ensure that undocumented students in our sample were eligible for in-state tuition prior to Fall 2001 and to increase the comparability of documented and undocumented noncitizens. Among citizens, 3,500 (12 percent) are excluded due to this restriction.

The final three columns of Table 1 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. Compared to noncitizens, CUNY senior college students with US citizenship significantly differ on nearly all the background characteristics in the sample, though most differences are small in magnitude. Importantly, there are far fewer significant differences in the characteristics of undocumented and documented noncitizens. Undocumented students are significantly more likely to be black or Hispanic and, correspondingly, significantly less likely to be white or Asian than their documented classmates. Undocumented students are also significantly less likely to require remediation and enroll in selective CUNY institutions than documented noncitizens.[15]

Table 1 also highlights one of the unique features of our study location. New York City is the largest city in the US and contains a diverse student population (of both natives and immigrants). Undocumented youth living in New York City come from all over the world, not just from Latin and South America as is common in other regions. Thus, the responses of CUNY undocumented students to tuition shocks may not resemble the responses of other undocumented students across the nation. We address concerns over the generalizability of our estimates in Section 5.4 by examining whether the impact of the tuition increase varies by race/ethnicity.

# 4 Empirical Framework

Our data and setting provide several advantages for estimating effects of price shocks on undocumented students' outcomes. First, the decision to eliminate the in-state tuition subsidy for undocumented students appears to have been made in reaction to 9/11 and not to any patterns observed among undocumented or documented noncitizens before fall 2001 (Rincón, 2008). Thus, there is no reason to expect undocumented students were experiencing changes in any relevant drivers of attainment, such as financial need, courses, institutions, or grades, relative to their documented counterparts who were not exposed to the price shock. Second, undocumented students are ineligible for most federal, state, and private grants and loans, making it difficult for these students to buffer the tuition hike with increased financial support from other sources.[16] In addition, no exceptions to the elimination of the in-state tuition subsidy appear to have been granted, or additional supports made available, rendering all previously-eligible undocumented students subject to the

[15] We classify institutions' selectivity using the Barron's Guide, which places the following colleges in each rank: "Very Competitive" includes Baruch; "Competitive" includes Brooklyn, City, Hunter, John Jay, and Queens; Less "Competitive" includes Lehman; "Noncompetitive" includes City Tech, Medgar Evers, New York City College of Technology, Staten Island, and York.

[16] Undocumented 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.

same price increase. These circumstances means that our estimates will more closely measure the theoretical effects of price shocks on postsecondary attainment than studies that examine the effect of a specific subsidy (e.g., Pell Grant aid) on the outcomes of students who have access to other potentially offsetting resources (e.g., federal loans). Third, most surveys do not request that respondents state their immigration status or provide documentation to validate their responses. Thus, studies that rely on federal data sources, such as the ACS or the CPS, code both undocumented students and other noncitizen immigrants (namely, permanent residents and those with legal visas) as treatment group members, leading to measurement error in students' exposure to changes in tuition. Our unique data set allows us to more accurately identify the undocumented, thereby reducing measurement error and allowing us to difference out non-price impacts on attainment by using documented noncitizens as the control group.[17]

To estimate the effects of the price shock, we focus on the three semesters surrounding the policy change and the semester of the price shock: fall 2000 through fall 2003 (with spring 2002 at the center of the series).[18] We estimate generalized difference-in-differences models, where we allow the impact of the policy change on attainment to have persistent effects after in-state rates were restored to undocumented students:

$$Y_{isct} = \beta_1 Treat_t \times Undoc_i + \beta_2 Post_t \times Undoc_i + \boldsymbol{\gamma}\mathbf{X_i} + \delta_{sc} + \delta_t + \tau \times \delta_c + \epsilon_{isct} \quad (1)$$

In equation (1), $Y_{isct}$ is one of several attainment outcomes in semester $t$ for student $i$ who initially entered college $s$ as a member of entry cohort $c$. $Undoc_i$ is set to one if the student is undocumented and $\mathbf{X_i}$ is a vector of student covariates measured in the first semester of college including indicators for documentation status (permanent resident, student visa holder, or asylee/refugee), initial degree program (associate's versus bachelor's degree), high school GPA, high school type (NYC public, NYC private, GED, or other New York state school), need for remedial courses, disability, age, gender, race/ethnicity (Black, Hispanic, White, or other), and single parent status. We include semester and college by entry cohort fixed effects, $\delta_t$ and $\delta_{sc}$, respectively, and cohort-specific linear trends $\tau \times \delta_c$, where $\tau = t - c$ represents semesters since entry. Finally, under the identifying assumption that the outcomes of undocumented and documented noncitizen students would have followed similar trends in the absence of the price increase, $\epsilon_{isct}$ represents a random error component. Student-semester observations are dropped following receipt of any degree.[19] Standard errors are clustered at the college by entry cohort level.

The coefficient on the interaction between the indicator for the semester of the price increase ($Treat_t$)

[17] For instance, our identification strategy can account for the removal of the subsidy leading all noncitizens to feel unwelcome in the CUNY System. In other settings, such "chilling effects" have been shown to alter documented noncitizens' behavior (e.g., Watson, 2014).

[18] In Section 5.2, we show that our results are robust to larger and smaller windows.

[19] Less than 1 percent of student by semester observations are dropped due to this restriction. Few students receive a degree within the expected time to graduation. Across all cohorts, only 12 percent of students graduated within four years.

and undocumented status, $\beta_1$, represents the change in attainment during the semester of the tuition hike on the outcomes of undocumented students relative to documented noncitizens. Additionally, $\beta_2$ 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.[20]

The main identifying assumption underlying our research design is that, in the absence of the tuition increase, the outcomes of documented noncitizen and undocumented students in the spring 2002 and the following semesters would have followed similar trends. A possible violation of this assumption would be underlying trends in the outcome variables that are correlated with the policy change. Examination of the pre-policy trends in attainment, discussed in the following section, suggests that prior to the tuition increase, outcomes of documented and undocumented noncitizens followed similar paths.

In this case, an additional potential violation comes from the terrorist attacks of September 11, 2001. These attacks had a major impact on New York City residents and institutions and may have uniquely influenced the schooling choices of immigrant students. If the undocumented students felt disproportionately impacted, perhaps reducing their schooling investments due to a decrease in morale or increased fear of deportation, then observed changes in spring 2002 could be attributed 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 can test whether the policy change led to reductions in attainment among documented noncitizens relative to US citizens. Documented noncitizens at CUNY were not subject to the new tuition policy, but they were exposed to the post 9/11 environment and may have felt a similar level of hostility and reduction in attachment to US institutions. As discussed in the following section, trends before and after 9/11 reveal no evidence that documented noncitizens' enrollment or attainment differed from that of US citizens.

# 5 The Effect of the Price Shock on Attainment

To illustrate our identification strategy and preview our main results, we plot average reenrollment (Figure 1), credits attempted (Figure 2), and credits earned (Figure 3) of citizens, documented noncitizens, and undocumented students over the seven semesters surrounding the policy change.[21] In each figure, 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 outcomes of citizens. Differences between the black and dashed gray lines before and after the policy change will

[20] Main effects for $Treat_t$ and $Post_t$ are subsumed by the vector of semester fixed effects while the main effect for $Undoc_i$ is included in $\mathbf{X_i}$.

[21] Note that we use the term "reenrollment" as opposed to "enrollment" as the latter is typically used to refer to the decision to enter college. We also do not use the term "persistence" because we focus here on reenrollment that is not conditional on the previous semester.

approximate our difference-in-differences estimates.

Prior to spring 2002, both documented and undocumented noncitizens were more likely to reenroll relative to US citizens (Figure 1). The decline in mean reenrollment for all groups reflects the increased likelihood of exits over time. Reenrollment rates for documented noncitizen and undocumented senior college students are quite similar prior to spring 2002, while in spring of 2002, the increase in tuition for undocumented students corresponds with a substantial drop in reenrollment. Following spring 2002, reenrollment continues to monotonically decline for all three groups. Relative to documented noncitizens and citizens, decreases in undocumented students' reenrollment slow slightly after in-state tuition rates were restored.

Figures 2 and 3 display trends in credits attempted and credits earned, respectively. Since we do not condition on enrollment, changes in credits attempted and earned reflect a combination of intensive (e.g., course load reductions or less effort devoted to courses) and extensive margin (e.g., exit) responses. Documented and undocumented noncitizens attempt and earn more credits than citizens in all semesters, and trends in credits attempted and earned are similar for documented and undocumented noncitizens before spring 2002. In the semester of the price shock, undocumented students' attempt and earn fewer credits relative to documented noncitizens, suggesting that the policy change reduced both credits attempted and earned. Following spring 2002, undocumented students' credit accumulation rebounds slightly, but remains lower than in the pre-spring 2002 semesters.

The pre- and post-policy trends of US citizens and documented noncitizens reveal no substantial differences between these two groups in any of the figures. The absence of a difference indicates that documented noncitizens appear not to have reacted to the tuition hike (via a chilling effect) or to the terrorist attacks of 9/11. Although the absence of a reaction to 9/11 among documented noncitizens (relative to citizens) does not entirely rule out 9/11 as an explanation for undocumented students' attainment decreases, it suggests that 9/11 is unlikely to be the major cause of the academic responses we observe.

## 5.1 Effects on reenrollment, credits attempted, and credits earned

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) for all senior college students (Column 1) and separately for those who enrolled initially as bachelor's degree seekers (Column 2) and associate degree seekers (Column 3). The results in the first column of Panel A shows that the price shock led to a 7 percentage-point decrease in undocumented senior college students' reenrollment (an 8 percent drop relative to fall 2001). The price shock resulted in smaller effects on students' reenrollment in the semesters after the tuition hike was reversed,

leading to a 3 percentage point (3 percent) decrease. The test of equality of the estimated parameters on the interaction of undocumented and spring 2002 and the interaction of undocumented and post-spring 2002 reveal that the two are statistically different from one another. The difference between the immediate (spring 2002) and medium-run (post spring 2002) effects of the tuition hike suggests that either students induced to leave college in spring 2002 by the price shock returned to school after in-state tuition rates were restored or that approximately half of the students who initially dropped out in response to the price shock would have left in the following semesters even in the absence of the policy change.

We distinguish between these explanations with two additional analyses. We first examine whether the policy change affected the hazard of exit, defined as the probability of exit in semester $t$ conditional on semester $t-1$ enrollment (Panel B). Consistent with the estimates displayed in Panel A, undocumented students experienced a 7 percentage point increase in their exit hazard in spring 2002 (a 61 percent increase relative to fall 2001). We observe no differences in exit rates post spring 2002, consistent with the expectation that students who remained enrolled in the semester of the tuition hike would be unlikely to disproportionately leave school once the subsidy was reinstated. We then examine impacts on reentry among students who "stopped-out" of college for at least one semester (Panel C). Undocumented students who left CUNY prior to spring 2002 were 8 percentage points (33 percent) less likely to return to college in the semester of the price shock. Furthermore, even when in-state tuition rates were restored, the probability of reentry remained negative (albeit insignificant) among undocumented students who had previously left school. The persistent reduction in reenrollment after in-state rates were restored suggests that approximately half of the students induced to leave in the spring of 2002 were inframarginal and would have left college in the following semesters, even in the absence of the price shock. Columns (2) and (3) provide results for bachelor's and associate's degree-seeking students. Responses to the price shock are statistically indistinguishable for these two groups except in the case of the post-2002 impact on reenrollment, with only bachelor's degree seeking students experiencing significant reductions after in-state rates were restored ($p = 0.09$).

As shown in Table 3, undocumented students also attempted and earned fewer credits in spring 2002. We do not condition on enrollment when estimating impacts on credits attempted and earned, therefore, our point estimates represent the combined impact of the price increase on intensive and extensive margin responses. Undocumented students attempted 0.9 fewer credits in spring 2002 (a 10 percent decrease relative to fall 2001) and earned 0.8 (9 percent) fewer credits. Undocumented students continued to earn fewer credits even after in-state tuition rates were restored. The similarities between effects on credits attempted and earned, as well as the trends shown in Figures 2 and 3, suggest that observed decreases in credit accumulation are largely driven by decreases in credits attempted, rather than declines in course pass rates. Thus, we focus on estimating impacts on credits earned in the remaining analyses. Estimated impacts on credits attempted

are quite similar (available upon request). Columns (2) and (3) show that the impact of the price increase did not differ by initial degree program.

In Figures 4 and 5, we display point estimates and corresponding 95 percent confidence intervals from a modified version of equation (1), where $Treat_t \times Undoc_i$ and $Post_t \times Undoc_i$ are replaced with interactions between $Undoc_i$ and a set of indicators for semesters before and after the price increase. Fall 2001 (the semester immediately prior to the price shock) serves as the omitted category. These event study models serve two purposes. First, we can explicitly test for differences in the trends in documented and undocumented students' outcomes prior to the price shock. Second, we can test how the impact of the price shock changes in each semester after spring 2002.

Differences in reenrollment rates between documented and undocumented students are not statistically significant before the price shock (Figure 4). However, undocumented students were more than 5 percentage points less likely to reenroll in spring 2002 and around 3 percentage points less likely to reenroll in fall 2002. After fall 2002, impacts on undocumented students' reenrollment remain negative but are no longer statistically significant at the 5 percent level. Trends in credits earned for documented and undocumented students prior to the price shock are also not statistically distinguishable (Figure 5). Although the drop in credits earned by undocumented students relative to their documented counterparts is largest in spring 2002, statistically significant differences in credit accumulation persist for at least two semesters following the restoration of in-state rates.[22]

## 5.2 Robustness tests

Table 4 displays estimated effects on reenrollment and credits earned from three robustness tests. Column (1) includes estimates from models that include student fixed effects. Column (2) includes estimates from models that use a larger window around the policy change (4 semesters) and Column (3) includes estimates from models that use a smaller window (2 semesters).

Including student fixed effects will account for student-specific time-invariant characteristics. If students' time-invariant unobservable characteristics are correlated with both their attainment and exposure to the policy change, our main estimates will suffer from omitted variables bias. Conversely, our fixed effects models use students' own pre-treatment outcomes as a counterfactual for their 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, since these students experience no change in their exposure to the tuition increase. The disadvantage of including student fixed effects is that attenuation bias due to classical measurement error

[22] Appendix Figure A.1 shows corresponding estimates for senior college students by initial degree program. Patters are similar for students in bachelor's and associate degree programs.

in the "treatment" variables will be exacerbated, biasing our estimates towards zero. Even if documentation status contains 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. The second and third robustness tests vary the size of the window around the policy change that we use to define our sample, to show that our results are not driven by the three semester window we use in our main specification.

The estimated effects of the policy change are robust to these alternative specifications. Across all four specifications (the original and the alternatives discussed above), the price increase led to a 7 to 8 percent decrease in reenrollment in spring 2002, and a 2 to 3 percent continued reduction after the subsidy was restored. Correspondingly, the price increase caused an 8 to 9 percent decrease in credits earned in spring 2002, and a 5 to 6 percent decrease post spring 2002.

### 5.3 Disentangling extensive and intensive margin responses to the price shock

To better understand how much of the reduction in credits earned due to the price shock was driven by decreases in reenrollment, we estimate a set of models that condition on enrollment. First, we examine the effect of the price increase on credits earned by enrolled students (Table 5, Panel A). The price increase led to an insignificant 0.2 (2 percent) decrease in credits earned by undocumented students during spring 2002. This point estimate is less than 20 percent of the size of the estimated impact when we do not condition on reenrollment, suggesting that the price increase primarily reduced attainment by inducing students to leave school. In the semesters after spring 2002, enrolled students earned 0.3 (3 percent) fewer credits.

The reductions in attainment that persist after in-state tuition rates were restored to undocumented students could stem from several channels. First, affected undocumented students could respond to the price increase by increasing their non-school work investments (and lowering their course loads). Alternatively, undocumented students who reenroll following the price increase could be negatively selected, and thus, would have earned fewer credits even in the absence of the policy change. We find no effect of the price shock on enrolled students' GPA (Table 5, Panel B).[23] Our 95 percent confidence intervals rule out impacts larger than a -0.13 point decrease and a 0.05 point increase in enrolled students' GPAs in spring 2002.

The estimated effects on credits earned and GPA capture both the effect of the policy change on attainment and effects driven through selection into the sample of enrolled students. We explore selection into reenrollment in the semester of the price hike by comparing undocumented students who exited in spring 2002 to those who exited in earlier semesters, with documented noncitizens again serving as a counterfactual.

[23] We lose a small number of student by semester observations with a missing GPA. We find no relationship between the probability of having a missing GPA in a semester in which the student is classified as being enrolled and the interaction between undocumented status and spring 2002 or post-spring 2002 (available upon request).

We focus on cumulative credits earned and cumulative GPA in the semester before exit. As shown in Table 6, relative to documented noncitizens, undocumented students who left college in spring 2002 had earned significantly more credits than those who left college prior to the price shock.

To disentangle the potential effect of differential selection from lasting impacts of the price shock on credit accumulation and course grades, we reestimate the credits earned and GPA models with student fixed-effects. By including a student fixed effect in equation (1), our results will represent within-student variation in outcomes in spring 2002 and later semesters and exclude any contamination due to differential selection into persistence following the price shock. As shown in Appendix Table A.1, estimated effects on credits earned and GPA from student fixed-effects models are very similar to those displayed in Table 5, suggesting that the price shock no substantial effect on enrolled students' credits or grades.

## 5.4 Heterogeneity by gender and race/ethnicity

Prior research suggests female bachelor's degree seeking students may be more sensitive to tuition supports than their male counterparts (e.g., Dynarski, 2008; Angrist, Lang and Oreopoulos, 2009). To determine whether the price increase had larger effects on female undocumented students' attainment, we estimate equation (1) separately for male and female students and find no evidence of heterogeneous impacts of the price change on students' outcomes by gender (Table 7).

We also test for differences in the effect of the price increase on Hispanic versus non-Hispanic students. Undocumented students in New York City are less likely to be Hispanic than undocumented students elsewhere in the US, therefore, this exercise allows us to determine how generalizable our results are to undocumented students outside of the CUNY System. Again, we estimate equation (1) separately for Hispanic and non-Hispanic students; results are displayed in Table 8. Undocumented Hispanic students' generally experienced larger reductions in reenrollment and credits earned in spring 2002, yet only the difference in the effect of the price increase on credit accumulation between Hispanic and non-Hispanic students is statistically significant ($p = 0.025$).[24]

## 5.5 Heterogeneity by entry cohort

Finally, we test for heterogeneous impacts of the price increase by entry cohort, separately examining students who entered a CUNY institution in 1999, 2000, and 2001.[25] Earlier entrants were able to gain more experience

[24] In Appendix Table A.2, we display results from models that separate non-Hispanic students into three additional categories: Black, Asian, and White. Though the magnitudes differ slightly, $p$-values from tests of the equality of the estimated parameters across the four equations suggest no differences in impact by race/ethnicity.

[25] We group students by academic rather than calendar year. Thus, students entering a CUNY institution in spring 2000 are classified as entering college in 1999 and students who enter in spring 2001 are classified as 2000 entrants. Our estimates are robust to only examining fall entrants (available upon request).

and likely faced less uncertainty over whether they ultimately would be successful in college when the price shock hit. As shown in Table 9, we find evidence of heterogeneous responses by the length of time undocumented students had potentially been enrolled when the price shock occurred. For undocumented students who entered college in 1999 or 2000, the price shock led to a 3 to 7 percentage point (5 to 9 percent) reenrollment decline in spring 2002. However, students in these entry cohorts - who potentially had been enrolled for at least a year when the price shock hit - experienced no lasting declines in reenrollment after spring 2002. In other words, all of the students in the 1999 and 2000 entry cohorts induced to leave school due to the price shock appeared to be inframarginal. For 2001 entrants, the immediate impact of the price shock on reenrollment - an 8 percentage point (8 percent) decrease - was not statistically distinguishable from that experienced by earlier cohorts ($p = 0.132$). However, 2001 entrants also experienced lasting declines in reenrollment, with the probability of reenrollment falling by 7 percentage points (7 percent) in semesters after spring 2002. Taken with the estimated effect on enrollment in the semester of the price shock, this implies that close to 90 percent of the students induced to leave school by the price shock in the 2001 cohort were marginal, and would have remained in school for several more semesters had they not been exposed to the tuition increase. We can reject the equality of post-spring 2002 effects across entry cohorts with $p = 0.013$. We find similar patterns across entry cohorts when examining impacts on credit accumulation, although both the 2000 and 2001 entry cohorts appear to experience lasting reductions in credit receipt.[26]

# 6 Longer-Run Outcomes and Degree Receipt

In the previous section, we show that undocumented students belonging to the 1999 entry cohort did not experience persistent declines in attainment after in-state tuition rates were restored. Conversely, undocumented students who entered college in fall 2001 experienced lasting reductions in both reenrollment and credit accumulation, while 2000 entrants experienced reductions in credit accumulation (but not reenrollment) after in-state tuition rates were restored. We build upon these patterns to estimate effects of the tuition hike on long-run attainment, including cumulative credits earned and degree receipt eight years after entry. To do so, we compare differences in the outcomes of undocumented students who entered college

[26]To further illustrate differences in the effect of the price shock on short- and longer-run attainment, we estimate event-study models in which we replace $Treat_t \times Undoc_i$ and $Post_t \times Undoc_i$ in equation (1) with interactions between $Undoc_i$ and a set of indicators for the semesters before and after the price increase (fall 2001 is the omitted category). We examine effects on cumulative credits earned for up to 12 semesters after the price shock. These coefficients and 95 percent confidence intervals are displayed in Appendix Figure A.3. Prior to the price shock, there are no differences in cumulative credits earned between documented and undocumented students. Undocumented students in the 1999 entry cohort experience a small reduction in cumulative credits in spring 2001, impacts on their credit accumulation are never statistically significant. Undocumented students belonging to the 2000 entry cohort do experience a statistically significant reduction in cumulative credits earned for several semesters during and following the price shock. However, differences in cumulative credits earned are no longer significant once five semesters after the tuition hike have passed. Finally, students who entered college in fall 2001 experience immediate and lasting reductions in cumulative credits earned starting in spring 2001. Even 12 semesters later, these students have earned approximately 6 fewer credits in total than their documented peers.

in 1999 relative to those who entered in 2000 and 2001, again using differences in documented noncitizens outcomes across entry cohorts to generate a counterfactual:

$$Y_{isc} = \alpha_{2000} Undoc_i \times \mathbf{1}\left[cohort = 2000\right] + \alpha_{2001} Undoc_i \times \mathbf{1}\left[cohort = 2001\right] + \boldsymbol{\eta}\mathbf{X_i} + \psi_{sc} + \nu_{isc} \qquad (2)$$

Here, $Y_{ics}$ is cumulative credits, associate's degree receipt, and bachelor's degree receipt eight years after entry for student $i$ who initially enrolled in college $s$ as a member of cohort $c$. $Undoc_i$ indicates whether a student is undocumented. The interaction between $Undoc_i$ and indicators for belonging to the 2000 or 2001 entry cohort represents the treatment we are interested in estimating, with corresponding coefficients $\alpha_{2000}$ and $\alpha_{2001}$. The vector $\mathbf{X_i}$ includes the same set of controls as in our main equation and we also control for school by cohort fixed effects, $\psi_{sc}$. Each observation represents a unique student and standard errors are clustered at the school by cohort level.

Our identifying assumption rules out unobservable differences between students entering college in 1999 and those entering in 2000 and 2001 that vary with documentation status and affect long-run attainment. Although this assumption is fundamentally untestable, we test whether there are differences in observable characteristics along these dimensions; estimates are displayed in Table 10. We find no evidence of statistically significant changes in the observable characteristics of students by entry cohort that vary by undocumented status and entry and we do not reject the hypothesis that the estimates are jointly insignificant ($p = 0.731$ for the 2000 cohort and $p = 0.274$ for the 2001 cohort). Finally, this approach relies on the assumption that undocumented students who entered a senior college in 1999 were only affected by the price shock in the short-run. If some students in this entry cohort also experienced declines in long-run attainment, our estimates provide a lower bound of the true impacts of the price shock on long-run outcomes.

Table 11 provides estimates from equation (2) for three samples: Panel A for all senior college students; Panel B for students who initially entered college in a bachelor's degree program, and Panel C for students who initially entered an associate's degree program. Only undocumented students from the fall 2001 entry cohort experienced significant reductions in long-run credit accumulation. Relative to undocumented students who entered college in 1999, 2001 entrants earned 7 fewer credits (a 9 percent decrease). Effects are large in magnitude for bachelor's degree seeking students relative to associate degree seeking students (an 8 versus 6 credit reduction), but similar in percentage terms (both represent a 10 percent reduction).

The second through fourth columns present estimated impacts on degree receipt within eight years of entry. Column (2) present estimated effects of the price shock on receipt of any credential (including certificates), while Columns (3) and (4) focus on receipt of associate of arts or science (AA/AS) and bachelor of arts or science (BA/BS) degrees, respectively. Again, only undocumented students who entered college in

fall 2001 experienced a reduction in degree receipt over the long-run. However, these impacts are substantial and include a 10 percentage point (22 percent) reduction in receipt of any degree and a marginally significant 9 percentage point (22 percent) reduction in bachelor's degree receipt. Effects on bachelor's degree receipt are driven by bachelor's degree-seeking students, who experienced a 12 percentage point (23 percent) reduction, while associate's degree-seeking students were 12 percentage points (46 percent) less likely to earn an associate's degree within eight years of entry.

# 7 Conclusions

Our results suggest that CUNY's decision to temporarily eliminate the in-state tuition subsidy reduced undocumented students' short and long-run attainment. Given that senior college students faced an 113 percent increase in tuition during the semester of the price hike, our estimates imply a price elasticity of reenrollment equal to -0.07. This result is very similar to the -0.10 price elasticity of reenrollment implied by the estimates from Angrist et al. (2014). While we find no substantial differences in effects by initial degree program, gender, or Hispanic ethnicity, we find that the timing of the price shock matters a great deal for long-run attainment. Students with only one semester of experience prior to the price shock experienced a 9 percent reduction in credit accumulation and a 22 percent decrease in degree receipt eight years after entry. The latter effect implies a price elasticity of degree receipt equal to -0.19 (under the assumption that students viewed the initial price hike as permanent). Finally, we find no evidence that the tuition hike affected the grades of undocumented student who remained enrolled following the price shock.

Prior research suggests that in-state tuition subsidies induce undocumented students into college. Our paper demonstrates that this public investment also increases undocumented students' likelihood of degree completion. The full return on this investment is difficult to calculate in the current policy regime. On the benefits side, a major question concerns the labor market returns to a college degree for undocumented youth who currently have no permanent legal authority to live and work in the US. Even students who are enrolled in the DACA program have only temporary authorization to work and it is unclear whether this program will become permanent legislation. While returns to a year of college have been estimated at roughly 10 percent for an average student (e.g., Kane and Rouse 1995; Card, 1999), undocumented college graduates may experience lower private returns. The benefits of increasing the college persistence and attainment of undocumented immigrants are likely to accrue in non-market realms (Lochner, 2011). For instance, undocumented youth who obtain college diplomas may be more civically engaged, clearly not as voters, but as consumers and participants in the informal civic and political context (e.g., Dee 2004; Milligan, Moretti and Oreopoulos 2004). In addition, assuming these undocumented youth are not deported, many

are likely to have children who will be US citizens and who will benefit from having parents with some college education (e.g., Currie and Moretti 2003). In sum, the subsidy is likely to be welfare-enhancing, yet the most substantial private benefits are uncertain given these students' lack of access to formal labor markets.

Though our findings are most generalizable to undocumented students, they also suggest that unanticipated increases in tuition and reductions in financial aid can have large effects on low-income students beyond the enrollment margin. Our paper shows that a one-time price hike had lasting effects, particularly for students who had just begun their college careers and for whom the uncertainty in the returns to their college investment was greatest. The fact that the shock was only temporary suggests that these results provide a lower bound of the effects of permanent price increases on college degree attainment.

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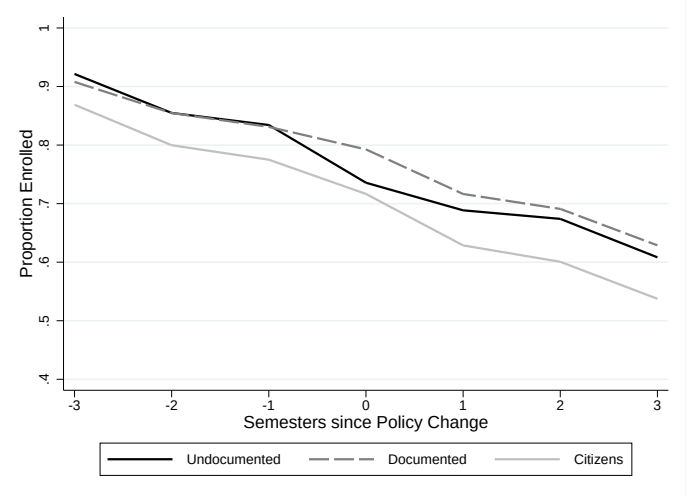
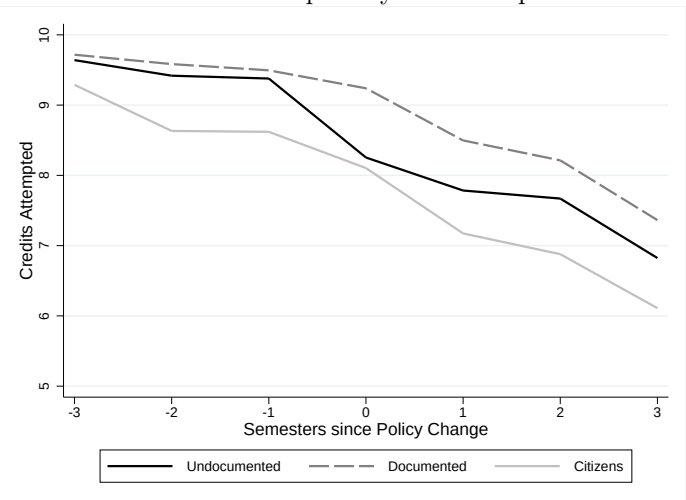
# Figures and Tables

Figure 1: Trends in Reenrollment by Citizenship and Documentation



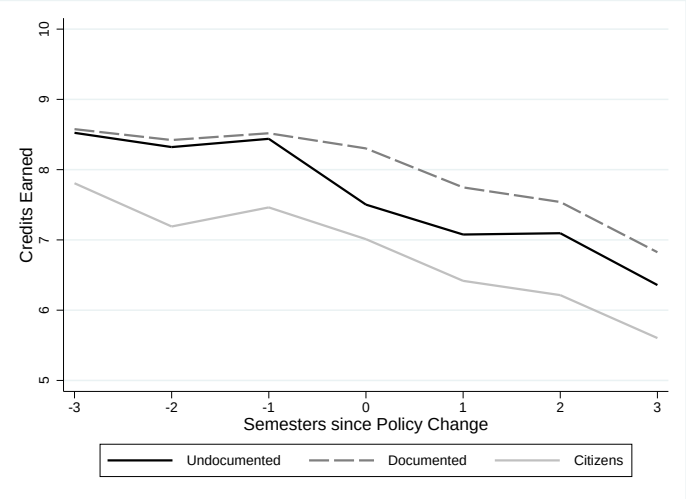

*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY undergraduate degree-seeking students belonging to the Fall 1999 through Fall 2001 entering cohorts who earned a high school diploma or GED from New York State and initially entered a senior college (Baruch, Brooklyn, City, Hunter, John Jay, Queens, Lehman, City College of Technology, Staten Island, or York College). Each line represents the share of students in the specified group who were enrolled in the specified semester. Spring 2002 is represented by "0". See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 2: Trends in Credits Attempted by Citizenship and Documentation



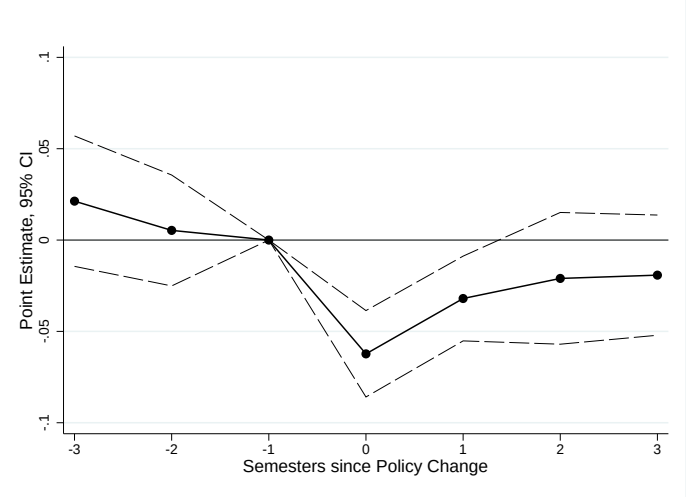

*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY undergraduate degree-seeking students who belonged to the Fall 1999 through Fall 2001 entering cohorts and earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each line represents average credits attempted by students in the specified group and semester. Spring 2002 is represented by "0". See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 3: Trends in Credits Earned by Citizenship and Documentation



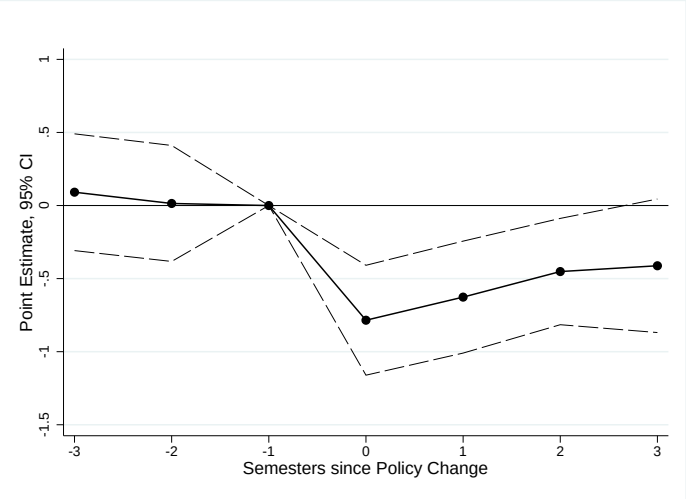

*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY undergraduate degree-seeking students who belonged to the Fall 1999 through Fall 2001 entering cohorts and earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each line represents average credits earned by students in the specified group and semester. Spring 2002 is represented by "0". See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 4: Estimated Effects of the Price Shock on Reenrollment by Semester




*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY noncitizen undergraduate degree-seeking students belonging to the Fall 1999 through Fall 2001 entering cohorts who earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each marker represents the point estimate from a modified version of equation (1), where an indicator for undocumented status is interacted with indicators for semesters before/after spring 2002 (with fall 2001 serving as the omitted category). Spring 2002 is represented by "0". The thin dashed line represents the corresponding 95 percent confidence interval. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure 5: Estimated Effects of the Price Shock on Credits Earned by Semester




*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who belonged to the Fall 1999 through Fall 2001 entering cohorts and earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each marker represents the point estimate from a modified version of equation (1), where an indicator for undocumented status is interacted with indicators for semesters before/after spring 2002 (with fall 2001 serving as the omitted category). Spring 2002 is represented by "0". The thin dashed line represents the corresponding 95 percent confidence interval. 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

| | (1) Citizens | Noncitizens | | Tests of equality ($p$-value) | | |
|---|---|---|---|---|---|---|
| | | (2) Documented | (3) Undocumented | Citizen vs. noncitizens | Documented vs. undoc. | All three groups |
| Age | 19 | 19 | 19 | 0.01 | 0.835 | 0.035 |
| Female | 0.58 | 0.57 | 0.58 | 0.509 | 0.619 | 0.711 |
| Race/ethnicity: | | | | | | |
| Asian/Pacific Islander | 0.10 | 0.30 | 0.26 | <0.001 | 0.004 | <0.001 |
| Black | 0.28 | 0.26 | 0.33 | 0.007 | <0.001 | <0.001 |
| Hispanic | 0.29 | 0.21 | 0.25 | <0.001 | 0.002 | <0.001 |
| White | 0.33 | 0.23 | 0.16 | <0.001 | <0.001 | <0.001 |
| Single parent | 0.02 | 0.01 | 0.01 | 0.128 | 0.633 | 0.283 |
| Disabled | 0.03 | 0.01 | 0.02 | <0.001 | 0.293 | <0.001 |
| Foreign-born | 0.08 | 1 | 1 | | | |
| Permanent resident | -- | 0.94 | -- | | | |
| Visa-holder | -- | 0.06 | -- | | | |
| Refugee | -- | 0 | -- | | | |
| Need any remediation | 0.33 | 0.42 | 0.38 | <0.001 | 0.039 | <0.001 |
| High school type: | | | | | | |
| NYC public | 0.69 | 0.86 | 0.85 | <0.001 | 0.179 | <0.001 |
| NYC private | 0.18 | 0.05 | 0.04 | <0.001 | 0.446 | <0.001 |
| GED | 0.06 | 0.07 | 0.06 | <0.001 | 0.741 | <0.001 |
| High school GPA (0-100) | 78 | 80 | 80 | <0.001 | 0.488 | <0.001 |
| Missing high school GPA | 0.02 | 0.02 | 0.02 | <0.001 | 0.663 | <0.001 |
| Bachelor's degree program | 0.61 | 0.63 | 0.62 | 0.002 | 0.395 | 0.005 |
| Initial institution selectivity: | | | | | | |
| Very competitive | 0.09 | 0.13 | 0.1 | <0.001 | 0.038 | <0.001 |
| Competitive | 0.48 | 0.45 | 0.47 | <0.001 | 0.208 | <0.001 |
| Less/noncompetitive | 0.43 | 0.42 | 0.42 | 0.119 | 0.835 | 0.291 |
| Observations | 25,999 | 8,919 | 876 | | | |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students from New York belonging to the Fall 1999 through Fall 2001 entering cohorts who initially enrolled in a senior college (Baruch, Brooklyn, City, Hunter, John Jay, Queens, Lehman, City College of Technology, Staten Island, or York College). 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 Enrollment

| | (1) All | (2) Bachelor's degree seeking | (3) Associate's degree seeking |
|---|---|---|---|
| *A. Reenrollment* | | | |
| Undocumented x spring 2002 | -0.065 | -0.071 | -0.054 |
| | (0.012)** | (0.014)** | (0.020)* |
| Undocumented x post-spring 2002 | -0.029 | -0.042 | 0.001 |
| | (0.013)* | (0.015)** | (0.022) |
| Test of equality (*p*- value) | 0.005 | 0.007 | 0.070 |
| Fall 2001 undocumented mean | 0.83 | 0.88 | 0.77 |
| Impact in % change: spring 2002 | -8% | -8% | -7% |
| Impact in % change: post-spring 2002 | -3% | -5% | 0.1% |
| Observations | 61,481 | 38,674 | 22,807 |
| *B.* Pr(*exit* $_t$ \|*enrolled* $_{t-1}$) | | | |
| Undocumented x spring 2002 | 0.067 | 0.069 | 0.063 |
| | (0.013)** | (0.014)** | (0.025)* |
| Undocumented x post-spring 2002 | 0.010 | 0.012 | 0.002 |
| | (0.010) | (0.011) | (0.020) |
| Test of equality (*p*- value) | <0.001 | <0.001 | 0.067 |
| Fall 2001 undocumented mean | 0.11 | 0.09 | 0.13 |
| Impact in % change: spring 2002 | 61% | 77% | 48% |
| Impact in % change: post-spring 2002 | 9% | 13% | 2% |
| Observations | 50,185 | 33,405 | 16,780 |
| *C.* Pr(*return* $_t$ \|*not enrolled* $_{t-1}$) | | | |
| Undocumented x spring 2002 | -0.080 | -0.156 | -0.023 |
| | (0.041)+ | (0.073)* | (0.051) |
| Undocumented x post-spring 2002 | -0.032 | -0.100 | 0.016 |
| | (0.037) | (0.064) | (0.050) |
| Test of equality (*p*- value) | 0.132 | 0.369 | 0.149 |
| Fall 2001 undocumented mean | 0.24 | 0.33 | 0.18 |
| Impact in % change: spring 2002 | -33% | -47% | -13% |
| Impact in % change: post-spring 2002 | -13% | -30% | 9% |
| Observations | 11,296 | 5,269 | 6,027 |

*Source*: CUNY administrative data. *Note*s: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts who initially enrolled in a senior college. Each column within a panel represents a separate regression. Panel B sample is limited to students in these cohorts who were enrolled in the prior semester. Panel C sample is limited to students in these cohorts who were not enrolled in the prior semester. 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, indicators for whether the student was a single parent, needed remediation, was undocumented, or was disabled at entry, semester fixed effects, institution by cohort fixed effects, and cohort-specific time trends. Column (1) regressions also control for initial degree program (associate's versus bachelor's degree). Student by semester observations are dropped following degree receipt.

Table 3: The Impact of the Tuition Increase on Credits Attempted and Earned

| | (1) All | (2) Bachelor's degree seeking | (3) Associate's degree seeking |
|---|---|---|---|
| *A. Credits attempted* | | | |
| Undocumented x spring 2002 | -0.913 | -0.912 | -0.914 |
| | (0.176)** | (0.226)** | (0.299)** |
| Undocumented x post-spring 2002 | -0.547 | -0.494 | -0.637 |
| | (0.180)** | (0.213)* | (0.346)+ |
| Test of equality (*p*- value) | 0.033 | 0.048 | 0.273 |
| Fall 2001 undocumented mean | 9.4 | 10.5 | 7.5 |
| Impact in % change: spring 2002 | -10% | -9% | -12% |
| Impact in % change: post-spring 2002 | -6% | -5% | -8% |
| Observations | 61,481 | 38,674 | 22,807 |
| *B. Credits earned* | | | |
| Undocumented x spring 2002 | -0.763 | -0.862 | -0.603 |
| | (0.159)** | (0.228)** | (0.221)* |
| Undocumented x post-spring 2002 | -0.511 | -0.469 | -0.586 |
| | (0.156)** | (0.180)* | (0.297)+ |
| Test of equality (*p*- value) | 0.165 | 0.077 | 0.950 |
| Fall 2001 undocumented mean | 8.4 | 9.6 | 6.6 |
| Impact in % change: spring 2002 | -9% | -9% | -9% |
| Impact in % change: post-spring 2002 | -6% | -5% | -9% |
| Observations | 61,481 | 38,674 | 22,807 |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts who initially enrolled in a senior college. 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 covariates and specification. Student by semester observations are dropped following degree receipt.

Table 4: Robustness of Estimated Impacts on Reenrollment and Credits Earned

| | (1) Student fixed effects | (2) Larger window (+/- 4 semesters) | (3) Smaller window (+/- 2 semesters) |
|---|---|---|---|
| *A. Reenrollment* | | | |
| Undocumented × spring 2002 | -0.058 | -0.064 | -0.060 |
| | (0.013)** | (0.012)** | (0.011)** |
| Undocumented × post-spring 2002 | -0.019 | -0.024 | -0.024 |
| | (0.015) | (0.014)+ | (0.014)+ |
| Test of equality (*p* -value) | 0.007 | 0.006 | 0.006 |
| Fall 2001 undocumented mean | 0.83 | 0.83 | 0.83 |
| Impact in % change: spring 2002 | -7% | -8% | -7% |
| Impact in % change: post-spring 2002 | -2% | -3% | -3% |
| Observations | 61,481 | 73,768 | 45,777 |
| *B. Credits earned* | | | |
| Undocumented × spring 2002 | -0.673 | -0.738 | -0.737 |
| | (0.170)** | (0.166)** | (0.165)** |
| Undocumented × post-spring 2002 | -0.378 | -0.412 | -0.497 |
| | (0.187)* | (0.156)* | (0.161)** |
| Test of equality (*p* -value) | 0.141 | 0.082 | 0.212 |
| Fall 2001 undocumented mean | 8.4 | 8.4 | 8.4 |
| Impact in % change: spring 2002 | -8% | -9% | -9% |
| Impact in % change: post-spring 2002 | -5% | -5% | -6% |
| Observations | 61,481 | 73,768 | 45,777 |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 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 covariates and specification. 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.

Table 5: Effect of the Tuition Increase on the Attainment of Enrolled Students

| | (1) All | (2) Bachelor's degree seeking | (3) Associate's degree seeking |
|---|---|---|---|
| *A. Credits earned \| enrolled* | | | |
| Undocumented × Spring 2002 or later | -0.175 | -0.148 | -0.284 |
| | (0.172) | (0.234) | (0.226) |
| Undocumented × Post-Spring 2002 | -0.322 | -0.093 | -0.916 |
| | (0.174)+ | (0.153) | (0.352)* |
| Test of equality (*p*- value) | 0.473 | 0.834 | 0.022 |
| Fall 2001 undocumented mean | 10.3 | 11 | 8.8 |
| Impact in % Change - Spring 2002 | -2% | -1% | -3% |
| Impact in % Change - Post-Spring 2002 | -3% | -1% | -10% |
| Observations | 45,866 | 31,275 | 14,591 |
| *B. GPA \| enrolled* | | | |
| Undocumented × Spring 2002 | -0.041 | -0.064 | 0.014 |
| | (0.045) | (0.059) | (0.054) |
| Undocumented × Post-Spring 2002 | -0.025 | -0.039 | 0.012 |
| | (0.032) | (0.042) | (0.038) |
| Test of equality (*p*- value) | 0.624 | 0.547 | 0.959 |
| Fall 2001 undocumented mean | 2.57 | 2.68 | 2.36 |
| Impact in % Change - Spring 2002 | -2% | -2% | 1% |
| Impact in % Change - Post-Spring 2002 | -1% | -1% | 1% |
| Observations | 45,817 | 31,242 | 14,575 |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts who initially enrolled in a senior college. 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 covariates and specification. Panels B and C samples condition on enrollment in semester $t$. Student by semester observations are dropped following degree receipt.

Table 6: Selection into Exit in Spring 2002

| | (1) Cumulative GPA | (2) Cumulative credits earned |
|---|---|---|
| Undocumented x spring 2002 | 0.208 | 2.493 |
| | (0.145) | (1.180)* |
| Fall 2001 undocumented mean | 1.99 | 18 |
| Impact in % change: spring 2002 | 10% | 14% |
| Observations | 4,291 | 4,291 |

*Source*: CUNY administrative data. *Note*s: Sample includes first-time CUNY noncitizen undergraduate degree-seeking senior college students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts and exited from college in semester $t$. Dependent variable is cumulative GPA or cumulative credits earned at the time of exit. Each column 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. Student by semester observations are dropped following degree receipt.

Table 7: Heterogeneity in the Effect of the Tuition Increase by Gender

| | (1) Female | (2) Male | Test of equality ($p$- value) |
|---|---|---|---|
| *A. Reenrollment* | | | |
| Undocumented x spring 2002 | -0.073 | -0.054 | 0.447 |
| | (0.016)** | (0.018)** | |
| Undocumented x post-spring 2002 | -0.035 | -0.020 | 0.515 |
| | (0.016)* | (0.019) | |
| Fall 2001 undocumented mean | 0.84 | 0.83 | |
| Observations | 35,290 | 26,191 | |
| *B. Credits earned* | | | |
| Undocumented x spring 2002 | -0.881 | -0.591 | 0.422 |
| | (0.209)** | (0.280)* | |
| Undocumented x post-spring 2002 | -0.548 | -0.457 | 0.757 |
| | (0.172)** | (0.262)+ | |
| Fall 2001 undocumented mean | 8.9 | 7.9 | |
| Observations | 35,290 | 26,191 | |

*Source*: CUNY administrative data. *Note*s: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 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. Student by semester observations are dropped following degree receipt.

Table 8: Heterogeneity in the Effect of the Tuition Increase by Hispanic Ethnicity

| | (1) Hispanic | (2) Non-hispanic | Test of equality (*p*- value) |
|---|---|---|---|
| *A. Reenrollment* | | | |
| Undocumented x spring 2002 | -0.083 | -0.058 | 0.414 |
| | (0.024)** | (0.015)** | |
| Undocumented x post-spring 2002 | 0.002 | -0.037 | 0.280 |
| | (0.031) | (0.015)* | |
| Fall 2001 undocumented mean | 0.83 | 0.84 | |
| Observations | 13,189 | 48,292 | |
| *B. Credits earned* | | | |
| Undocumented x spring 2002 | -1.384 | -0.541 | 0.025 |
| | (0.318)** | (0.189)** | |
| Undocumented x post-spring 2002 | -0.583 | -0.482 | 0.799 |
| | (0.346)+ | (0.176)** | |
| Fall 2001 undocumented mean | 8.1 | 8.6 | |
| Observations | 13,189 | 48,292 | |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 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. Student by semester observations are dropped following degree receipt.

Table 9: Heterogeneity in the Effect of the Tuition Increase by Entry Year

| | (1) 1999 | (2) 2000 | (3) 2001 | Test of eq. (*p*- value) |
|---|---|---|---|---|
| *A. Reenrollment* | | | | |
| Undocumented × spring 2002 | -0.033 | -0.073 | -0.084 | 0.132 |
| | (0.020) | (0.020)** | (0.018)** | |
| Undocumented × post-spring 2002 | -0.002 | -0.009 | -0.073 | 0.013 |
| | (0.022) | (0.022) | (0.018)** | |
| Test of equality (*p*- value) | 0.119 | 0.011 | 0.549 | |
| Fall 2001 undocumented mean | 0.68 | 0.79 | 1.00 | |
| Impact in % change: spring 2002 | -5% | -9% | -8% | |
| Impact in % change: post-spring 2002 | -0.3% | -1% | -7% | |
| Observations | 21,586 | 24,539 | 15,356 | |
| *B. Credits earned* | | | | |
| Undocumented × spring 2002 | -0.452 | -0.937 | -0.928 | 0.224 |
| | (0.216)* | (0.216)** | (0.354)* | |
| Undocumented × post-spring 2002 | 0.181 | -0.546 | -1.072 | <0.001 |
| | (0.271) | (0.283)+ | (0.155)** | |
| Test of equality (*p*- value): | 0.071 | 0.19 | 0.642 | |
| Fall 2001 undocumented mean | 7.0 | 8.0 | 10.0 | |
| Impact in % change: spring 2002 | -6% | -12% | -9% | |
| Impact in % change: post-spring 2002 | 3% | -7% | -11% | |
| Observations | 21,586 | 24,539 | 15,356 | |

*Source*: CUNY administrative data. *Note*s: Sample includes first-time CUNY noncitizen undergraduate degree-seeking senior college students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 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. Student by semester observations are dropped following degree receipt.

Table 10: Changes in Observed Characteristics between Affected and Unaffected Undocumented Entry Cohorts

| | Undocumented × 2000 entrant | Undocumented × 2001 entrant |
|---|---|---|
| *Dependent var:* | | |
| Age | 0.035 | 0.328 |
| | (0.196) | (0.250) |
| Female | 0.025 | 0.061 |
| | (0.049) | (0.041) |
| Black | 0.001 | 0.025 |
| | (0.042) | (0.046) |
| Hispanic | 0.045 | 0.019 |
| | (0.035) | (0.037) |
| White | -0.031 | -0.043 |
| | (0.047) | (0.048) |
| Single Parent | -0.006 | 0.003 |
| | (0.005) | (0.010) |
| Needs remediation | -0.023 | -0.028 |
| | (0.039) | (0.037) |
| Disabled | -0.018 | -0.026 |
| | (0.019) | (0.018) |
| High school GPA | 0.843 | 0.657 |
| | (0.828) | (0.681) |
| Missing hs GPA | -0.005 | -0.004 |
| | (0.009) | (0.007) |
| NYC public high school | 0.019 | 0.036 |
| | (0.035) | (0.028) |
| GED | -0.026 | -0.000 |
| | (0.018) | (0.014) |
| Test of joint sig. (*p*- val.) | 0.731 | 0.274 |
| Observations | 9,798 | |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking senior college students from New York belonging to the Fall 1999 through Fall 2002 entering cohorts. Each cell displays the coefficient on the interaction between undocumented status and belong to a cohort that entered between Spring 2002. All models include controls for undocumented status, entry cohort, and cohort linear time trends, allowed to vary by documentation status. Clustered standard errors (institution by cohort) in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$.

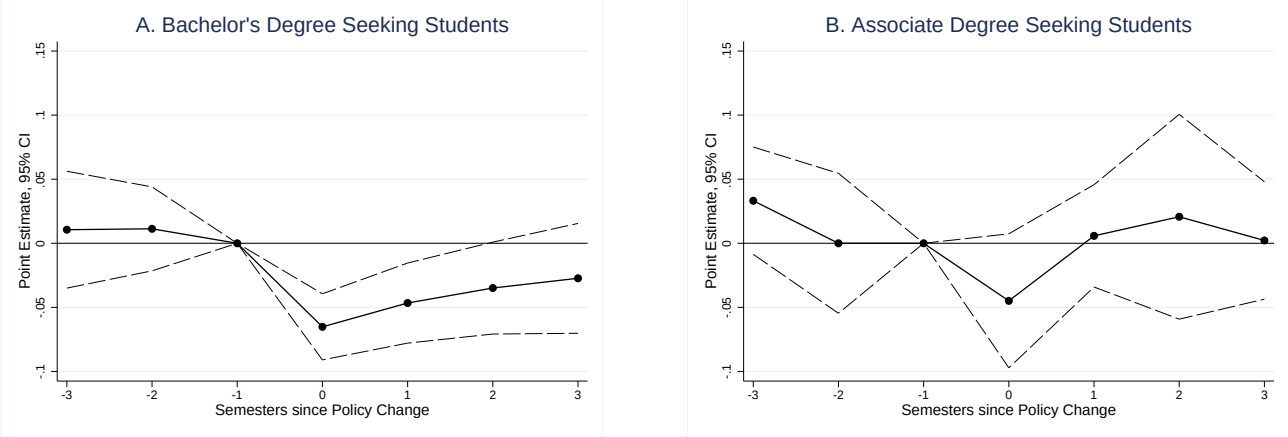
Table 11: Effects of the Tuition Increase on Cumulative Credits Earned and Degree Receipt

| | 1. Cumulative credits earned | Degree Receipt: 2. Any degree | 3. AA/AS | 4. BA/BS |
|---|---|---|---|---|
| *A. All senior college students* | | | | |
| Undocumented x 2000 entrant | -2.37 | -0.030 | -0.001 | -0.020 |
| | (3.69) | (0.047) | (0.026) | (0.041) |
| Undocumented x 2001 entrant | -7.01 | -0.104 | -0.042 | -0.086 |
| | (3.08)* | (0.047)* | (0.028) | (0.043)+ |
| Undocumented mean (1999) | 73.9 | 0.48 | 0.13 | 0.40 |
| Impact in % change: 2000 cohort | -3% | -6% | -1% | -5% |
| Impact in % change: 2001 cohort | -9% | -22% | -32% | -22% |
| Observations | 9,798 | 9,798 | 9,798 | 9,798 |
| *B. Bachelor's degree-seeking* | | | | |
| Undocumented x 2000 entrant | -5.07 | -0.017 | 0.011 | -0.026 |
| | (4.78) | (0.062) | (0.018) | (0.063) |
| Undocumented x 2001 entrant | -8.28 | -0.099 | 0.009 | -0.119 |
| | (4.47)+ | (0.064) | (0.016) | (0.064)+ |
| Undocumented mean (1999) | 84.4 | 0.55 | 0.04 | 0.52 |
| Impact in % change: 2000 cohort | -6% | -3% | 28% | -5% |
| Impact in % change: 2001 cohort | -10% | -18% | 23% | -23% |
| Observations | 6,190 | 6,190 | 6,190 | 6,190 |
| *C. Associate's degree-seeking* | | | | |
| Undocumented x 2000 entrant | 2.24 | -0.045 | -0.003 | -0.018 |
| | (4.67) | (0.052) | (0.044) | (0.040) |
| Undocumented x 2001 entrant | -5.78 | -0.109 | -0.119 | -0.038 |
| | (3.69) | (0.050)* | (0.044)* | (0.030) |
| Undocumented mean (1999) | 58.8 | 0.39 | 0.26 | 0.22 |
| Impact in % change: 2000 cohort | 4% | -12% | -1% | -8% |
| Impact in % change: 2001 cohort | -10% | -28% | -46% | -17% |
| Observations | 3,608 | 3,608 | 3,608 | 3,608 |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking senior college students who earned a high school diploma or GED from New York State and belonged to the Fall 1999 through Fall 2001 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 and belonging to either the 2000 or 2001 entry cohort. See Table 2 notes for description of additional control variables.

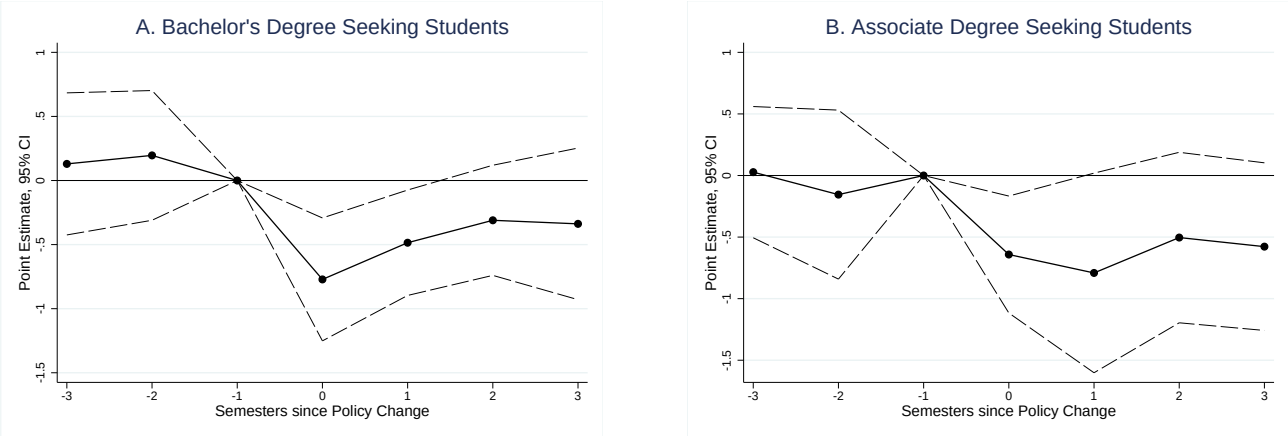
# Appendix A Additional Figures and Tables

Figure A.1: Estimated Effects of the Price Shock on Reenrollment by Semester by Initial Degree



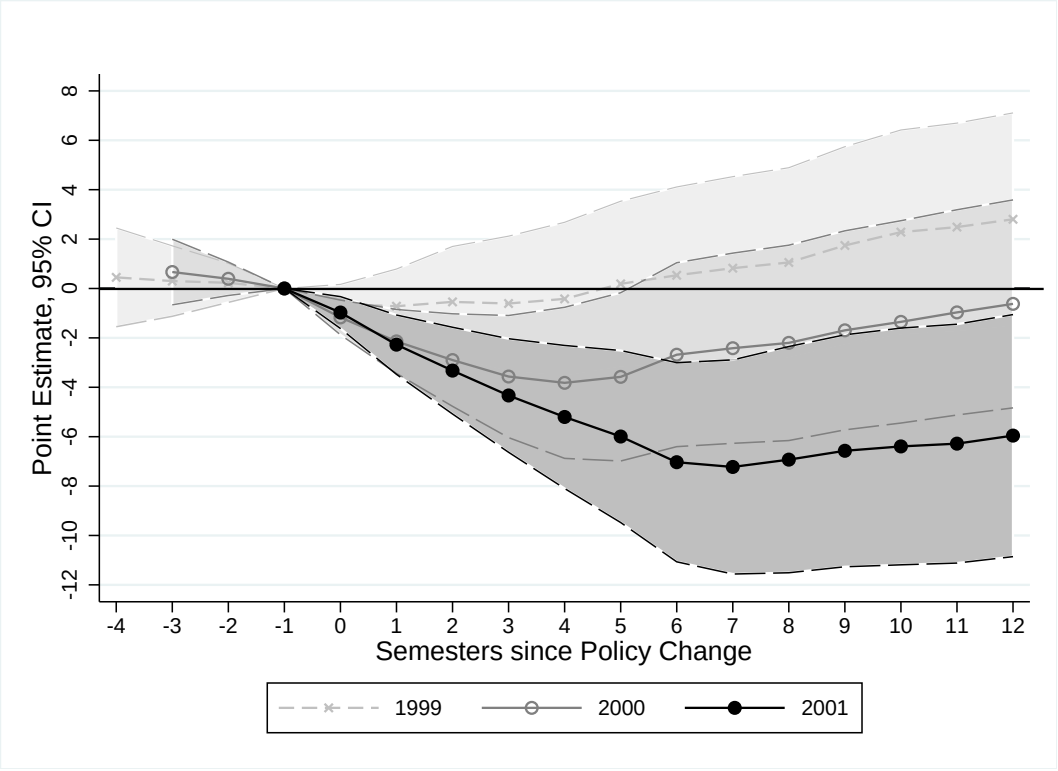

*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY noncitizen undergraduate degree-seeking students belonging to the Fall 1999 through Fall 2001 entering cohorts who earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each marker in Panels A and B represents the point estimate from a modified version of equation (1), where an indicator for undocumented status is interacted with indicators for semesters before/after spring 2002 (with fall 2001 serving as the omitted category). Spring 2002 is represented by "0". The thin dashed line represents the corresponding 95 percent confidence interval. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure A.2: Estimated Effects of the Price Shock on Credits Earned by Semester by Initial Degree




*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY noncitizen undergraduate degree-seeking students belonging to the Fall 1999 through Fall 2001 entering cohorts who earned a high school diploma or GED from New York State who initially enrolled in a senior college. Each marker in Panels A and B represents the point estimate from a modified version of equation (1), where an indicator for undocumented status is interacted with indicators for semesters before/after spring 2002 (with fall 2001 serving as the omitted category). Spring 2002 is represented by "0". The thin dashed line represents the corresponding 95 percent confidence interval. See text for definitions of documented and undocumented noncitizens. Student by semester observations following degree receipt are dropped.

Figure A.3: Cumulative Credits Earned by Semesters Since Entry and Entry Cohort




*Source*: CUNY administrative data. *Notes:* Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who belonged to the Fall 1999 through Fall 2002 entering cohorts and earned a high school diploma or GED from New York State and initially entered a senior college. Spring 2002 is represented by "0". Each marker represents the point estimate from a modified version of equation (1), where an indicator for undocumented status is interacted with indicators for semesters before/after spring 2002 (with fall 2001 serving as the omitted category) and the sample is limited to students who entered college in the specified semester. The thin dashed line and shaded area represents corresponding 95 percent confidence intervals.

Table A.1: The Impact of the Tuition Increase on the Attainment of Enrolled Undocumented Students: Student Fixed-Effects Models

| | (1) All | (2) Bachelor's degree seeking | (3) Associate's degree seeking |
|---|---|---|---|
| *A. Credits earned \| enrolled* | | | |
| Undocumented x Spring 2002 or later | -0.223 | -0.220 | -0.286 |
| | (0.178) | (0.235) | (0.243) |
| Undocumented x Post-Spring 2002 | -0.295 | -0.157 | -0.712 |
| | (0.194) | (0.176) | (0.417) |
| Test of equality (*p*- value) | 0.747 | 0.823 | 0.164 |
| Fall 2001 undocumented mean | 10.3 | 11.0 | 8.8 |
| Impact in % Change - Spring 2002 | -2% | -2% | -3% |
| Impact in % Change - Post-Spring 2002 | -3% | -1% | -8% |
| Observations | 45,866 | 31,275 | 14,591 |
| *B. GPA \| enrolled* | | | |
| Undocumented x Spring 2002 | -0.018 | -0.044 | 0.040 |
| | (0.041) | (0.050) | (0.059) |
| Undocumented x Post-Spring 2002 | 0.010 | -0.014 | 0.071 |
| | (0.034) | (0.042) | (0.044) |
| Test of equality (*p*- value) | 0.347 | 0.404 | 0.54 |
| Fall 2001 undocumented mean | 2.57 | 2.68 | 2.36 |
| Impact in % Change - Spring 2002 | -1% | -2% | 2% |
| Impact in % Change - Post-Spring 2002 | 0.4% | -1% | 3% |
| Observations | 45,817 | 31,242 | 14,575 |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts and were enrolled in semester $t$. 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 description of control variables and specification. All regressions include student fixed-effects. Student by semester observations are dropped following degree receipt.

Table A.2: Heterogeneity in the Impact of the Tuition Increase by Race/Ethnicity

| | (1) Asian | (2) Black | (3) Hispanic | (4) White | Test of equality ($p$- value) |
|---|---|---|---|---|---|
| *A. Reenrollment* | | | | | |
| Undocumented x spring 2002 | -0.064 | -0.055 | -0.083 | -0.037 | 0.757 |
| | (0.021)** | (0.023)* | (0.024)** | (0.032) | |
| Undocumented x post-spring 2002 | -0.005 | -0.026 | 0.002 | -0.057 | 0.438 |
| | (0.020) | (0.023) | (0.031) | (0.029)+ | |
| Fall 2001 undocumented mean | 0.88 | 0.77 | 0.83 | 0.91 | |
| Observations | 18,194 | 16,605 | 13,189 | 13,455 | |
| *B. Credits earned* | | | | | |
| Undocumented x spring 2002 | -0.407 | -0.604 | -1.384 | -0.439 | 0.102 |
| | (0.306) | (0.284)* | (0.318)** | (0.392) | |
| Undocumented x post-spring 2002 | -0.650 | -0.238 | -0.583 | -0.418 | 0.837 |
| | (0.302)* | (0.305) | (0.346)+ | (0.357) | |
| Fall 2001 undocumented mean | 9.3 | 7.6 | 8.1 | 9.6 | |
| Observations | 18,194 | 16,605 | 13,189 | 13,455 | |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts. Students classified as Native American are excluded due to their small group size. 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. See Table 2 notes for description of control variables and specification.

Table A.3: Heterogeneity in the Impact of the Tuition Increase by High School GPA

| *High school GPA:* | (1) Above median | (2) Below median | Test of eq. (*p*- value) |
|---|---|---|---|
| *A. Reenrollment* | | | |
| Undocumented × spring 2002 | -0.062 | -0.074 | 0.569 |
| | (0.015)** | (0.018)** | |
| Undocumented × post-spring 2002 | -0.037 | -0.025 | 0.598 |
| | (0.017)* | (0.017) | |
| Fall 2001 undocumented mean | 0.88 | 0.79 | |
| Observations | 30,717 | 30,764 | |
| *B. Credits earned* | | | |
| Undocumented × spring 2002 | -1.128 | -0.371 | 0.055 |
| | (0.247)** | (0.257) | |
| Undocumented × post-spring 2002 | -0.816 | -0.176 | 0.052 |
| | (0.194)** | (0.250) | |
| Fall 2001 undocumented mean | 9.9 | 6.8 | |
| Observations | 30,717 | 30,764 | |

*Source*: CUNY administrative data. *Notes*: Sample includes first-time CUNY noncitizen undergraduate degree-seeking students who earned a high school diploma or GED from New York State belonging to the Fall 1999 through Fall 2001 entering cohorts. Median high school GPA calculated with sample of noncitizen senior college students. 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 high school GPA. See Table 2 notes for description of control variables and specification.