ProPelled: The Effects of Grants on Graduation, Earnings, and Welfare

Online Appendix: Not for Publication

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Appendix A: Federal and Texas Financial Aid Programs

This appendix provides additional information about federal and state financial aid programs that potentially provided financial support to students in our analysis sample. All students must fill out a Free Application for Federal Student Aid (FAFSA) to qualify for any federal student aid. Many, but not all federal aid programs depend on a student's expected family contribution (EFC), which is the federal government's measure of their family's ability to pay for college.

A.1 Federal grant programs

The Pell Grant Program is the largest source of federal student grant aid. Only students with an EFC below a year-specific eligibility threshold qualify for Pell Grant aid, which is increasing as EFC decreases, up to the maximum award, which is only provided to students with a $0 EFC. The Department of Education publishes the Pell Grant award schedule in advance of each academic year.[1] Figure C.1 displays the maximum Pell Grant award (in nominal terms) between 2005 and 2017.

First and second year students in the cohorts we examine could also qualify for the federal Academic Competitiveness Grant (ACG) in their first and/or second years if they had completed a "rigorous secondary school program" and received a Pell Grant. The maximum ACG was $750 for first year students and $1300 for second year students. Upper level students could potentially qualify for the Science and Mathematics Access to Retain Talent (SMART) Grant, which was available to Pell Grant recipients with a 3.0 GPA that

[1] See https://ifap.ed.gov/dpcletters/attachments/1718PellPaymentDisbursementSchedules.pdf for the most recent schedule (AY 2018).

were majoring in Science, Technology, Engineering, Mathematics and foreign languages during their junior and senior year. SMART Grant recipients could receive $2000 per semester for up to four semesters. Both the ACG and SMART Grant Programs were discontinued in 2012.

A.2 Federal loan programs

The primary source of loan aid provided to undergraduates by the federal government comes from the Stafford Loan Program. Prior to 2010, schools could participated in one or both of two parallel federal lending programs: the William D. Ford Federal Direct Loan Program and the Federal Family Education Loan (FFEL) Program. FFEL loans were originated by by private lenders and guaranteed by the federal government. The 2010 Health Care and Education Reconciliation Act abolished the FFEL program. Most public bachelor's degree granting institutions in Texas participated in the FFEL Program before 2010.[2] We observe both FFEL and Direct Loans and from a student's perspective, the two programs were interchangeable.

Undergraduate students can potentially access Perkins and Parent PLUS loans. Perkins Loans are campus-based loans that schools can provide to students with exceptional financial need, but not all students with unmet need receive Perkins Loan offers due to limited program funding. PLUS loans are available to credit-worthy parents of students. If a parent is denied PLUS loans due to "an adverse credit history," their dependent student is eligible to borrow additional unsubsidized loans. Parents deemed credit-worth can borrow up to their student's cost of attendance.

Stafford loans have annual and lifetime borrowing limits. Annual borrowing limits were lower in 2008 than in later years. Specifically, dependent undergraduate students whose parents were not denied a PLUS loan could borrow up to $3500. In 2009, such students could borrow up to $5500. Students whose parents were denied a PLUS loan were eligible to borrow an additional $4000 in 2008 and an additional $6000 in 2009 and later years. Dependent students who are considered to be in their second year for federal loan eligibility purposes with unmet need can borrow up to $4,500 in subsidized loans, while students in their third year and above (i.e., those who have accumulated at least 60 credits) who have unmet need can borrow up to $5,500. The overall borrowing limits dependent students face are $6,500 in their second year and $7,500 as upper years ($3,500 and $5,500, respectively, prior to fall 2008), while independent students can borrow up to $10,500 in their second year and $12,500 in their third year and beyond ($7,500 and $10,500, respectively, prior to fall 2008). Students are limited in the total amount of federal debt they can incur during their undergraduate education. Dependent students can borrow up to $31,000 overall ($23,000 subsidized) and independent students can borrow up to $57,500 ($23,000 subsidized).[3]

[2] In 2008, Texas A&M University at Commerce was the only four-year public institution in Texas offering Direct Loans.
[3] See studentaid.ed.gov/types/loans for additional details.

An individual student's subsidized loan eligibility may be less than the amounts described above. According to the Department of Education's Federal Student Aid Handbook, a school cannot package a subsidized loan that exceeds a student's unmet need, which is equal to the cost of attendance minus EFC and other financial assistance (grants and work-study). Unsubsidized loans can be used to replace EFC. Thus, unsubsidized loans eligibility is limited to be no more than the total cost of attendance minus other financial assistance and subsidized loans.

The interest rate on unsubsidized loans was a constant 6.8 percent over the 2008 through 2011 academic years. Unsubsidized loans start incurring interest immediately, while subsidized loans do not accrue interest as long as the borrower has at least half-time enrollment (6 or more credits attempted in a given semester). The interest rate for subsidized loans after the borrower enters repayment by graduating or dropping below half-time attendance ranged from 6.8 percent in 2008 to 4.5 percent in 2011. The federal government also charges borrowers an origination fee. This amount is deducted from the loan prior to disbursement (e.g., in 2011, a student borrowing $3500 would receive funds equal to $3465). Origination fees dropped from 3 percent in 2007 to 1 percent in 2011.

A.3 Texas financial aid programs

The largest source of state grant aid is TEXAS (Towards EXcellence, Access and Success) Grant program. The TEXAS Grant provides need-based grants to students who have financial need, as determined by the federal EFC, graduated with a recommended high school diploma, and entered higher education in Texas within 16 months of graduation. TEXAS Grant recipients may renew their grant if they maintain a 2.5 GPA, complete 24 credit hours a year, and complete 75 percent of attempted credit hours. Only first year students can qualify for a TEXAS Grant, but students who qualify in their first year of college can receive awards for up to 5 years. The maximum award amount is the statewide average of a student's tuition and required fees (Texas Higher Education Coordinating Board 2011a). Schools must make up any difference between tuition and fees less federal aid and TEXAS Grants with institutional funds. This provides an incentive for schools to target students who are already receiving large amounts of federal aid when selecting TEXAS grant recipients.

Students enrolled in four-year public institutions may also qualify for Texas Public Educational Grant (TPEG) aid if they have financial need (as determined by institutions) but eligibility is not mechanically linked to EFC. TPEG is not funded by the state; it is a "set-aside" program under which institutions are required to use a portion of their tuition revenue to fund financial aid.[4] Over the 2008 academic year, students received $92 million dollars in TPEG aid (Texas Higher Education Coordinating Board 2009). The

[4]For additional details, see subchapters B, C, and D of the Texas Student Financial Assistance Act of 1975.

entry cohorts we examine could also qualify for the Texas Top 10 Percent Scholarship if they demonstrated financial need and graduated in the top 10 percent of their high school class. In 2010, total disbursements from the Texas Top 10 Percent scholarship equaled $20 million (Texas Higher Education Coordinating Board 2011b). The Top 10 Percent Scholarship is currently being phased out. Only renewal students are eligible to receive funding, and 2018 is the last year that any sizable number of students will qualify for aid.

Texas has one state loan programs of note, College Access Loans. College Access Loans require that students or cosigners meet credit requirements and students may borrow up to their total cost of attendance less other financial aid (federal and state grants plus federal loans). A second quasi-loan program (Texas B-On-Time Loans) does not have financial need requirements, and balances on this loan are forgiven if students finish their degree within four calendar years of starting or within six credit hours of the required total for the degree.

The state has other smaller grants and loans which target specific populations. For instance, the Texas Armed Services Scholarship Program is a limited scholarship to students appointed by the governor, lieutenant governor, state senators, or state representatives that is a scholarship for ROTC students.

Appendix B: Heterogeneous Effects for Returning Students

Students returning for a second or later year of college may also qualify for an automatic zero EFC based on family AGI. We estimate the effect of automatic zero eligibility on students in their 2nd, 3rd, and 4th year after entry; results are displayed in Appendix Table B.1. All groups of returning students experience significant increases in grant aid from automatic zero eligibility. In contrast to the effects we find for new entrants, eligibility does not significantly increase TEXAS Grant aid. This is because only new entrants can qualify for aid through this program. We find little evidence that eligibility has significant effects on contemporaneous credits attempted or GPA. Third and fourth year students who qualify for an automatic zero EFC based on family income reduce federal loans by 42 and 85 percent of the increase in grants, respectively.

Appendix Table B.2) displays estimated effects on longer-run outcomes. We find no evidence of statistically significant increases in graduation or earnings. Estimated impacts on graduation are not significantly different from zero and, when positive, smaller in magnitude than estimated effects for first-time entrants. Impacts on earnings are also insignificant and smaller than the estimates for entering students. Over the longer-run, eligibility generates significant reductions in student loan debt for third- and fourth-year students. These estimates provide suggestive evidence that grant aid has a larger impact on the outcomes of students in their first year of college and that aid received by upper year students may be used primarily

to reduce loan debt. However, the estimates are not sufficiently precise to say the effects are statistically distinguishable from the effects we find for entering students.

Table B.1: Heterogeneity in Effect of Automatic Zero Eligibility on Contemporaneous Outcomes: Second, Third, and Fourth Year Students

	(1) EFC = 0	(2) Total Grants	(3) Pell Grants	(4) TEXAS Grant aid	(5) Other grant aid	(6) Loans	(7) Earnings)	(8) Credits attempted	(9) GPA
A. Second year students									
Automatic zero eligible	0.477***	486***	492***	-40	34	-38	-14	0.272	0.058*
	(0.017)	(149)	(53)	(88)	(90)	(102)	(171)	(0.209)	(0.030)
Mean | ineligible	0.282	$9,231	$4,025	$3,018	$2,188	$3,652	$5,174	28.0	2.32
Observations	25,040	25,040	25,040	25,040	25,040	25,040	25,040	25,040	25,040
B. Third year students									
Automatic zero eligible	0.493***	803***	587***	100	116	-341***	12	0.014	-0.016
	(0.016)	(179)	(60)	(87)	(118)	(117)	(206)	(0.208)	(0.030)
Mean | ineligible	0.236	$8,709	$4,015	$1,988	$2,706	$4,327	$6,109	29.2	2.58
Observations	20,501	20,501	20,501	20,501	20,501	20,501	20,501	20,501	20,501
C. Fourth year students									
Automatic zero eligible	0.478***	632***	691***	2	-62	-538***	-220	0.158	-0.031
	(0.015)	(157)	(72)	(82)	(107)	(121)	(251)	(0.248)	(0.031)
Mean | ineligible	0.201	$8,192	$3,639	$1,856	$2,697	$4,812	$7,704	28.1	2.71
Observations	17,980	17,980	17,980	17,980	17,980	17,980	17,980	17,980	17,980

Notes: Dependent undergraduate students who were enrolled in a four-year Texas public institution in 2008 through 2011 and whose family adjusted gross income fell within $12,000 of the income eligibility threshold for an automatic zero EFC (see Figure 1 in main text). Students with AGIs at $1000 intervals are excluded. Students with family AGI below the year specific threshold are income-eligible for an automatic zero EFC. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. All models also include controls for a linear term in distance from the AGI threshold (allowed to vary on either side of the threshold), parent education, race, gender, age, Texas residency, and entry cohort. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above. All dollar amounts adjusted for inflation ($2013).

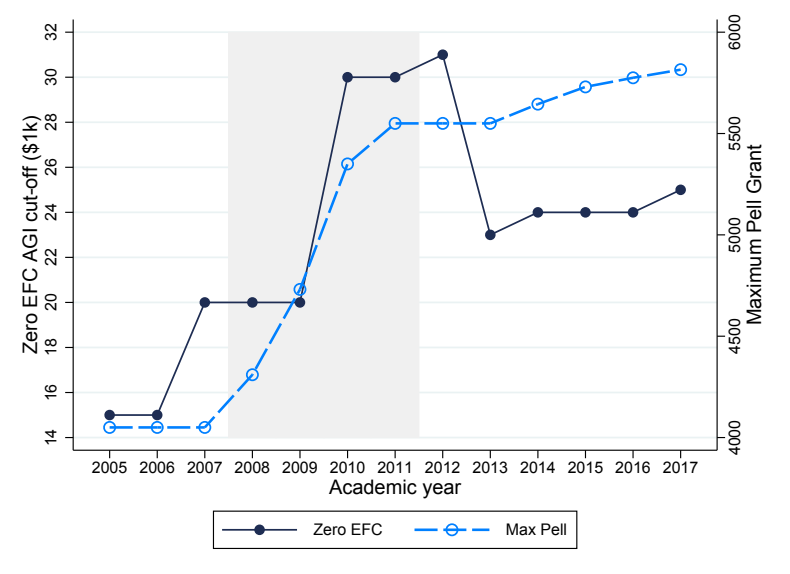
Table B.2: Heterogeneity in Effect of Automatic Zero Eligibility on Graduation and Earnings: Second, Third, and Fourth Year Students

			Graduate within:			Earnings at:		
	(1) Sum of grants	(2) Sum of loans	(3) 4 years of entry	(4) 5 years of entry	(5) 6 years of entry	(6) 4 years after entry	(7) 5 years after entry	(8) 6 years after entry
A. Second year students								
Automatic zero eligible	899	-41	-0.004	0.012	0.020	-11	188	789
	(546)	(359)	(0.011)	(0.013)	(0.014)	(365)	(523)	(582)
Mean | ineligible	$33,653	$15,779	0.23	0.45	0.55	$13,438	$19,287	$23,063
Observations	25,040	25,040	25,040	25,040	25,040	25,040	25,040	25,040
B. Third year students								
Automatic zero eligible	857	-779**	-0.003	0.011	-0.002	-183	183	477
	(617)	(387)	(0.014)	(0.016)	(0.016)	(407)	(519)	(571)
Mean | ineligible	$31,970	$16,634	0.27	0.55	0.68	$13,649	$19,883	$24,337
Observations	20,501	20,501	20,501	20,501	20,501	20,501	20,501	20,501
C. Fourth year students								
Automatic zero eligible	-126	-1191***	-0.012	0.003	0.014	162	724	687
	(454)	(403)	(0.016)	(0.013)	(0.013)	(405)	(516)	(587)
Mean | ineligible	$25,754	$15,186	0.29	0.59	0.73	$12,840	$19,113	$24,004
Observations	17,980	17,980	17,980	17,980	17,980	17,980	17,980	17,980

Notes: See Table B.1 notes for sample description and specification. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold. All dollar amounts adjusted for inflation ($2013).

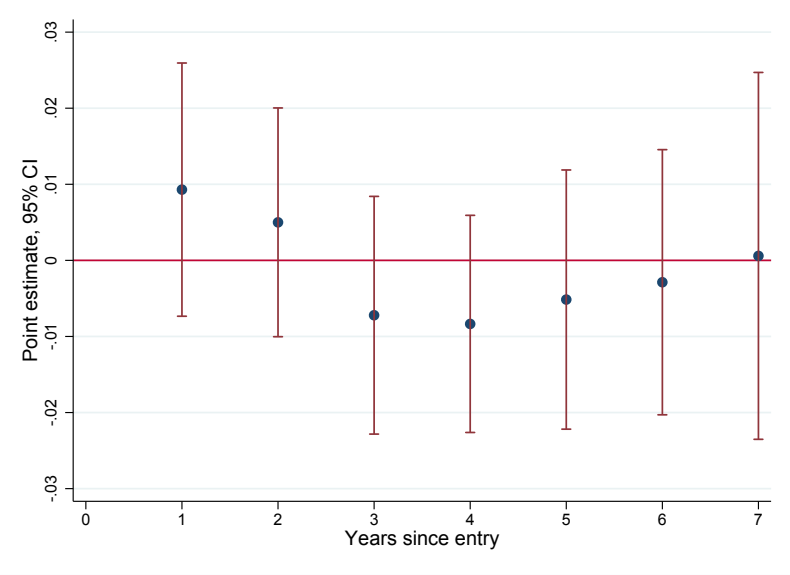
Appendix C: Additional Figures and Tables

Figure C.1: Trends in the Automatic Zero EFC Cut-Off and Maximum Pell Grant



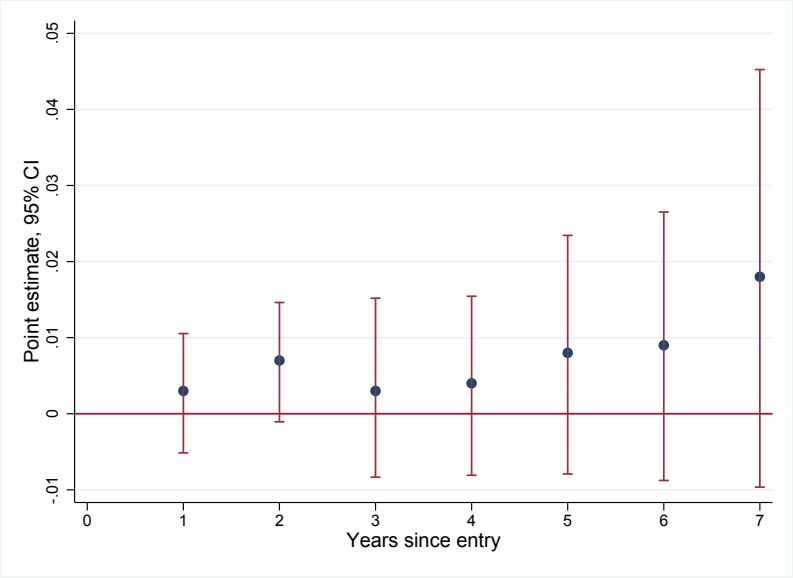
Notes: Markers indicate the nominal value of the maximum Pell Grant (light blue hollow circles) and the nominal value of the AGI cut-off for automatic zero EFC eligibility (navy circles) for the specified academic year. The gray shaded area represents the academic years over which students in the analysis sample entered college.

Figure C.2: No Effect on Transfers to Community Colleges



Notes: First-time dependent undergraduate students who enrolled in a four-year Texas public institution in 2008 through 2011 and whose family adjusted gross income fell within $12,000 of the income eligibility threshold for an automatic zero EFC. Students with AGIs at $1000 intervals are excluded.. Point estimates and 95% CI from regressions of the probability of enrollment in a Texas community college on income-eligibility for the automatic zero EFC, a linear term in distance from the threshold (allowed to vary on either side), and indicators for parent education, race, gender, age, Texas residency, and cohort. Confidence intervals constructed from robust standard errors clustered by initial institution by entry cohort.

Figure C.3: Share of Students with Earnings or Enrollment



Notes: See Figure C.2 notes for sample description. Dependent variable is the probability of having either earnings in a UI covered sector in Texas or any enrollment in a Texas public higher education institution (2- or 4-year) in a given academic year. Point estimates and 95% CI from regressions of the dependent variable on income-eligibility for the automatic zero EFC, a linear term in distance from the threshold (allowed to vary on either side), and indicators for parent education, race, gender, age, Texas residency, and cohort. Confidence intervals constructed using robust standard errors clustered at initial institution by entry cohort level.

Table C.1: Comparison of Analysis Sample with Nationally Representative Sample

	(1) Analysis sample	(2) 2008 NPSAS
A. Student demographics		
Male	0.46	0.44
Age	18.6	18.5
In-state student	0.96	0.95
Race		
Asian	0.05	0.10
Black	0.24	0.20
Hispanic	0.22	0.20
White	0.46	0.40
Parental education		
Mother < college degree	0.71	0.67
B. Financial aid		
EFC = 0	0.55	0.49
Pell Grant aid	$4,053	$3,098
Total Grants	$9,676	$6,889
Loans	$2,740	$2,301
Earnings	$3,844	$3,745
Work Study	$141	$135

Notes: Column 1 sample includes first-time dependent undergraduate students who enrolled in a four-year Texas public institution in 2008 through 2011 and whose family AGI fell within $12,000 of the income eligibility threshold for an automatic zero EFC and did not have an AGI at a $1000 interval. Column 2 sample includes first time dependent undergraduate bachelor's degree seeking students in the 2008 National Postsecondary Student Aid Study (NPSAS) who entered a public institution in 2008, filed a FAFSA, and had a family AGI within $12,000 of the income eligibility threshold.

Table C.2: Characteristics of Heapers and Nonheapers

	(1) Nonheapers	(2) Heapers
Male	0.46	0.47
Age	18.6	18.6
Texas Resident	0.96	0.93
Race		
Asian	0.05	0.11
Black	0.23	0.19
Hispanic	0.23	0.29
White	0.46	0.37
Missing	0.03	0.04
Parental education		
Father: <HS	0.13	0.09
Father: HS degree	0.45	0.44
Father: college degree	0.23	0.32
Father: missing	0.19	0.15
Mother: <HS	0.12	0.10
Mother: HS degree	0.48	0.45
Mother: college degree	0.29	0.36
Mother: missing	0.11	0.09
Observations	51,614	1,163

*Note*s: First-time dependent undergraduate students who enrolled in a four-year Texas public institution in 2008 through 2011 and whose family adjusted gross income fell within $18,000 of the income eligibility threshold for an automatic zero EFC (see Figure 1). Heapers are students with AGIs at $1000 intervals, nonheapers are all other students.

Table C.3: Correlations between Automatic Zero Eligibility and Other Student Characteristics

	(1) Father < HS deg	(2) Father HS degree	(3) Father missing ed	(4) Mother < HS deg	(5) Mother HS degree	(6) Mother missing ed	(7) Male	(8) 2008 cohort	(9) 2009 cohort	(10) 2010 cohort	(11) 2011 cohort
Automatic zero eligible	0.009	-0.013	0.007	0.006	-0.0002	-0.004	-0.013	0.006	0.023	-0.019	-0.010
	(0.008)	(0.011)	(0.008)	(0.007)	(0.010)	(0.006)	(0.011)	(0.011)	(0.016)	(0.013)	(0.013)
Mean | ineligible	0.13	0.48	0.18	0.11	0.50	0.11	0.47	0.23	0.24	0.26	0.27
Observations	36,697	36,697	36,697	36,697	36,697	36,697	36,697	36,697	36,697	36,697	36,697

*Note*s: See Figure C.2 notes for sample description. See Table 2 notes for and specification. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold.

Table C.4: OLS Estimates of the Effect of Automatic Zero EFC Eligibility on Longer-Run Academic Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Enrollment by years since entry							
Automatic zero eligible	0.003	0.012	0.020*	0.005	-0.010	-0.009	0.009
	(0.009)	(0.011)	(0.012)	(0.011)	(0.010)	(0.008)	(0.012)
Mean | ineligible	0.76	0.62	0.55	0.38	0.20	0.10	0.07
Observations	36,697	36,697	36,697	36,697	26,389	17,109	8,163
B. Credits attempted							
Automatic zero eligible	0.580**	0.831***	0.341	-0.149	-0.136	-0.012	-0.112
	(0.255)	(0.302)	(0.305)	(0.252)	(0.226)	(0.220)	(0.240)
Mean | ineligible	22.5	19.7	17.0	10.5	5.3	3.0	2.1
Observations	36,697	36,697	36,697	36,697	26,389	17,109	8,163
C. Graduation with X years							
Automatic zero eligible	--	0.001	0.003	0.019**	0.036***	0.034**	0.029
	--	(0.001)	(0.003)	(0.008)	(0.010)	(0.014)	(0.018)
Mean | ineligible	--	0.002	0.02	0.15	0.31	0.39	0.43
Observations	--	36,697	36,697	36,697	36,697	26,389	17,109

*Note*s: See Figure C.2 notes for sample description and Figure 7 notes for specification. Column heading indicates number of years following entry. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above.

Table C.5: OLS Estimates of the Effect of Automatic Zero EFC Eligibility on Longer-Run Labor Market Outcomes

	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Earnings by years since entry								
Automatic zero eligible	-161	-123	-37	198	663**	908**	1042**	1870***
	(114)	(135)	(172)	(239)	(310)	(400)	(458)	(618)
Mean | ineligible	$3,882	$5,657	$7,522	$9,605	$13,413	$17,944	$21,488	$23,583
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109
B. Federal income tax liabilities by years since entry								
Automatic zero eligible	6	3	8	21	66	131**	160*	312***
	(12)	(16)	(22)	(32)	(49)	(65)	(88)	(113)
Mean | ineligible	-$174	-$85	$122	$454	$1,012	$1,604	$2,126	$2,479
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109
C. FICA tax liabilities by years since entry								
Automatic zero eligible	-26	-17	-2	49	116**	147**	171**	282***
	(19)	(21)	(27)	(38)	(50)	(62)	(72)	(99)
Mean | ineligible	$671	$881	$1,152	$1,517	$2,205	$2,886	$3,382	$3,675
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109

*Note*s: See Figure C.2 notes for sample description and Figure 7 notes for specification. Column heading indicates number of years following entry. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above. All dollar amounts adjusted for inflation ($2013).

Table C.6: Effects on Labor Market Outcomes: Non-Winsorized Earnings and Probability of Nonzero UI Earnings

	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Earnings by years since entry (non-winsorized)								
Automatic zero eligible	-161	-123	-39	202	670**	907**	960*	4917
	(114)	(136)	(174)	(240)	(309)	(407)	(487)	(3039)
Mean | ineligible	$3,882	$5,657	$7,527	$9,605	$13,413	$17,975	$21,528	$23,492
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109
B. **1[**Any UI earnings] *by years since entry*								
Automatic zero eligible	-0.013	-0.004	-0.006	0.004	0.015**	0.012	0.008	0.024**
	(0.009)	(0.008)	(0.009)	(0.008)	(0.007)	(0.008)	(0.008)	(0.011)
Mean | ineligible	0.68	0.73	0.75	0.77	0.78	0.78	0.78	0.75
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109

*Note*s: See Figure C.2 notes for sample description and Figure 7 notes for specification. Column heading indicates number of years following entry. Each cell denotes an estimate from a separate regression. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. Panel B dependent variable is the probability of having no record of earnings in a UI covered sector in Texas. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table C.7: IV Estimates of the Effect of Grant Aid on Longer-Run Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Enrollment by years since entry							
First year grant aid ($1k)	0.004	0.018	0.030*	0.007	-0.015	-0.017	0.023
	(0.013)	(0.015)	(0.017)	(0.016)	(0.014)	(0.016)	(0.034)
Mean | ineligible	0.76	0.62	0.55	0.38	0.20	0.10	0.07
Observations	36,697	36,697	36,697	36,697	26,389	17,109	8,163
B. Graduate within X years							
First year grant aid ($1k)	--	0.002	0.005	0.028**	0.053***	0.050**	0.057*
	--	(0.002)	(0.005)	(0.012)	(0.015)	(0.020)	(0.034)
Mean | ineligible	--	<0.01	0.02	0.15	0.31	0.39	0.43
Observations	--	36,697	36,697	36,697	36,697	26,389	17,109
C. Earnings by years since entry							
First year grant aid ($1k)	-182	-54	292	978**	1334**	1545**	3584**
	(204)	(254)	(343)	(438)	(576)	(702)	(1522)
Mean | ineligible	$5,657	$7,522	$9,605	$13,413	$17,944	$21,488	$23,583
Observations	36,697	36,697	36,697	36,697	36,697	26,389	17,109
D. Federal income tax liabilities by years since entry							
First year grant aid ($1k)	4	11	32	98	193**	236*	610**
	(24)	(32)	(46)	(70)	(94)	(134)	(260)
Mean | ineligible	-$85	$122	$454	$1,012	$1,604	$2,126	$2,479
Observations	36,697	36,697	36,697	36,697	36,697	26,389	17,109
E. FICA tax liabilities by years since entry							
First year grant aid ($1k)	-25	-3	72	172**	217**	252**	551**
	(31)	(40)	(53)	(71)	(90)	(110)	(244)
Mean | ineligible	$881	$1,152	$1,517	$2,205	$2,886	$3,382	$3,675
Observations	36,697	36,697	36,697	36,697	36,697	26,389	17,109

*Note*s: See Figure C.2 notes for sample description. Each cell within a panel displays 2SLS estimates of the impact of an additional $1000 in first-year grant aid on the specified outcome by the number of years since entry specified in the column headings. The indicator for first-year income eligibility for the automatic zero EFC serves as the excluded instrument. All models also include controls for a linear term in distance from the AGI threshold (allowed to vary on either side of the threshold). Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold. All dollar amounts adjusted for inflation (2013$).

Table C.8: Robustness of Estimated Effects of Automatic Zero Eligibility on Graduation and Earnings

	Contemporaneous outcomes:				Graduate within:				Earnings after			
	(1) EFC = 0	(2) Total Grants	(3) Credits attempted	(4) GPA	(5) 4 years	(6) 5 years	(7) 6 years	(8) 7 years	(9) 4 years	(10) 5 years	(11) 6 years	(12) 7 years
A. No covariates												
Automatic zero eligible	0.523***	673***	0.246	0.043	0.022**	0.041***	0.039**	0.035*	733**	1011**	1148**	1978***
	(0.014)	(111)	(0.150)	(0.030)	(0.009)	(0.011)	(0.015)	(0.020)	(323)	(415)	(472)	(633)
Observations	36,697	36,697	36,697	36,697	36,697	36,697	26,389	17,109	36,697	36,697	26,389	17,109
B. Including students with AGIs at $1000 multiples												
Automatic zero eligible	0.521***	673***	0.184	0.034	0.019**	0.035***	0.032**	0.027	623**	931**	1064**	1805***
	(0.014)	(99)	(0.140)	(0.026)	(0.008)	(0.010)	(0.014)	(0.018)	(311)	(399)	(456)	(623)
Observations	37,488	37,488	37,488	37,488	37,488	37,488	26,954	17,452	37,488	37,488	26,954	17,452
C. $6K bandwidth												
Automatic zero eligible	0.488***	648***	0.196	0.055	0.029**	0.039***	0.052***	0.045**	889**	1364***	1575**	2551**
	(0.018)	(137)	(0.210)	(0.037)	(0.011)	(0.013)	(0.017)	(0.020)	(441)	(509)	(674)	(975)
Observations	18,996	18,996	18,996	18,996	18,996	18,996	13,809	9,051	18,996	18,996	13,809	9,051
D. $18K bandwidth												
Automatic zero eligible	0.556***	596***	0.103	0.027	0.017**	0.023***	0.025**	0.016	519**	724**	825**	1525***
	(0.014)	(89)	(0.110)	(0.023)	(0.007)	(0.008)	(0.011)	(0.015)	(233)	(304)	(315)	(538)
Observations	51,034	51,034	51,034	51,034	51,034	51,034	35,844	22,175	51,034	51,034	35,844	22,175
E. $18K bandwidth, quadratic in AGI												
Automatic zero eligible	0.492***	760***	0.270	0.041	0.024**	0.046***	0.046***	0.045**	861**	1250**	1128*	2189**
	(0.016)	(107)	(0.188)	(0.033)	(0.010)	(0.012)	(0.016)	(0.021)	(380)	(494)	(642)	(861)
Observations	51,034	51,034	51,034	51,034	51,034	51,034	35,844	22,175	51,034	51,034	35,844	22,175

*Note*s: First-time dependent undergraduate students who enrolled in a four-year Texas public institution in 2008 through 2011 and whose family adjusted gross income fell within $12,000 (Panels A and B), $6000 (Panel C), or $18,000 (Panels D and E) of the income eligibility threshold for an automatic zero EFC. Students with AGIs at $1000 intervals are excluded from sample in Panels A, C, D, and E. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. All models include a linear term in the distance from the AGI threshold (allowed to vary on either side of the threshold). Panels B through E models also include controls for parent education, race, gender, age, Texas residency, and entry cohort. Panel E models also include controls for a quadratic in the distance from the AGI threshold (allowed to vary on either side of the threshold). Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above. All dollar amounts adjusted for inflation (2013$).

Table C.9: Long-run Attainment Outcomes for Restricted Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Enrollment by years since entry							
Automatic zero eligible	0.020	0.009	0.021	-0.017	-0.013	-0.021	0.013
	(0.017)	(0.019)	(0.020)	(0.018)	(0.016)	(0.015)	(0.020)
Mean | ineligible	0.73	0.58	0.51	0.38	0.19	0.10	0.07
Observations	11,375	11,375	11,375	11,375	7,624	4,533	2,063
B. Credits attempted							
Automatic zero eligible	0.784**	0.571	0.528	-0.457	-0.433	0.051	0.134
	(0.394)	(0.510)	(0.551)	(0.463)	(0.415)	(0.392)	(0.466)
Mean | ineligible	21.8	18.9	16.1	10.4	5.7	3.0	1.9
Observations	11,375	11,375	11,375	11,375	7,624	4,533	2,063
C. Graduation with X years							
Automatic zero eligible	--	0.002	0.007	0.034**	0.031*	0.044*	0.046
	--	(0.002)	(0.005)	(0.014)	(0.018)	(0.023)	(0.034)
Mean | ineligible	--	0.001	0.01	0.12	0.28	0.37	0.39
Observations	--	11,375	11,375	11,375	11,375	7,624	4,533

Notes: See Section 5.4 text for description of restricted sample and Figure 7 notes for specification. Column heading indicates number of years following entry. Each cell denotes an estimate from a separate regression. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold.

Table C.10: Long-run Labor Market Outcomes for Restricted Sample

	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Earnings by years since entry								
Automatic zero eligible	-385**	-268	98	261	1093**	1614**	2450***	3819***
	(155)	(220)	(293)	(412)	(545)	(669)	(910)	(1374)
Mean | ineligible	$3,633	$5,652	$7,448	$9,603	$13,065	$17,309	$20,439	$22,659
Observations	11,375	11,375	11,375	11,375	11,375	11,375	7,624	4,533
B. Federal income tax liabilities by years since entry								
Automatic zero eligible	1	-4	23	9	157**	199*	392**	593**
	(18)	(26)	(36)	(55)	(75)	(101)	(163)	(235)
Mean | ineligible	-$173	-$79	$127	$468	$926	$1,511	$2,007	$2,416
Observations	11,375	11,375	11,375	11,375	11,375	11,375	7,624	4,533
C. FICA tax liabilities by years since entry								
Automatic zero eligible	-62**	-37	25	48	205**	250**	416**	570**
	(26)	(34)	(46)	(65)	(88)	(102)	(148)	(227)
Mean | ineligible	$643	$875	$1,135	$1,539	$2,140	$2,782	$3,213	$3,541
Observations	11,375	11,375	11,375	11,375	11,375	11,375	7,624	4,533

*Note*s: See Section 5.4 text for description of restricted sample and Figure 7 notes for specification notes for specification. Column heading indicates number of years following entry. Each cell denotes an estimate from a separate regression. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold. All dollar amounts adjusted for inflation (2013$).

Table C.11: The Effect of Automatic Zero Eligibility on Measures of Institutional Quality

A. Summary and inputs

		SAT scores				Share of students:		Admissions	
	(1) First principal component	(2) Verbal, 25th percentile	(3) Verbal 75th, percentile	(4) Math, 25th percentile	(5) Math, 75th percentile	(6) Receiving Pell	(7) Borrowing	(8) Applicants admitted	(9) Yield
Automatic zero eligible	0.175	4.818	6.156	5.378	6.035	-1.039	-0.979	0.695	0.862*
	(0.134)	(3.793)	(4.909)	(4.300)	(4.781)	(0.947)	(0.853)	(0.685)	(0.487)
Mean | ineligible	1.044	443	548	466	566	45.4	51.1	67.5	40.2
Observations	36,556	33,277	33,277	33,611	33,611	36,556	36,556	36,211	36,211

B. Resources and outputs

			Retention rate		Graduation rate		Expenditures per FTE:		
	(1) Tuition and Fees	(2) Student-faculty ratio	(3) Full-time students	(4) Part-time students	(5) Within 4 years	(6) Within 6 years	(7) Instruction	(8) Academic support svc.	(9) Student services
Automatic zero eligible	-16	0.136	0.878	1.751	0.806	1.301	-42	-1	-3
	(41)	(0.121)	(0.779)	(1.591)	(0.683)	(1.153)	(93)	(43)	(16)
Mean | ineligible	6945	20.9	71.9	52.1	21.8	43.8	7635	2536	1451
Observations	36,553	36,556	36,553	36,553	36,483	36,483	36,556	36,556	36,556

Notes: See Figure C.2 notes for sample description. Students who initially enrolled in schools missing a given measure of institutional quality are also omitted. Point estimates from OLS regressions of the dependent variable specified in each column on income-eligibility for the automatic zero EFC. All models also include controls for a linear term in distance from the AGI threshold (allowed to vary on either side of the threshold), parent education, race, gender, age, Texas residency, and entry cohort. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above. Panel A, column 1 dependent variable is the first principal component of the set of displayed measures of institutional quality. Institutional quality measures come from the IPEDS.

Table C.12: The Effect of Automatic Zero Eligibility on Ever Declaring STEM versus Non-STEM Majors

	(1) STEM	(2) Non-STEM
Automatic zero eligible	0.014*	-0.010
	(0.009)	(0.007)
Mean | ineligible	0.30	0.89
Observations	36,697	36,697

Notes: See Figure C.2 notes for sample description and Figure 7 notes for specification. Robust standard errors, clustered by initial institution by entry cohort, in parentheses; *** p<0.01, ** p<0.05, * p<0.1. "Mean | ineligible" represents the limit of the expected value of the dependent variable as the AGI threshold is approached from above the threshold. STEM majors are those with CIP codes included in the National Science Foundation's list of STEM disciplines (available at: https://www.lsamp.org/help/help_stem_cip_2010.cfm). Non-STEM majors are all other majors.

Table C.13: Annual Consumption, Expenditures, and Adjusted Gross Income for Current and Former College Students

	Consumption		Total expenditures		AGI		Observations
	Mean	Median	Mean	Median	Mean	Median	
A. Attending college, age 18-24							
Full sample	$19,610	$16,119	$24,586	$19,399	$51,115	$31,939	11,397
All with AGI	$19,343	$15,911	$24,301	$19,280	$51,115	$31,939	5,579
AGI $10k-$30k	$15,695	$13,489	$18,953	$15,984	$19,198	$18,427	1,271
AGI $30k-$50k	$17,255	$15,014	$21,005	$17,700	$39,692	$39,319	912
B. College educated							
Age 25-30	$23,811	$19,616	$29,387	$24,679	$52,739	$45,000	7,178
Age 31-35	$23,391	$19,004	$29,553	$24,558	$65,772	$55,774	6,814
Age 36-40	$24,296	$20,431	$30,478	$25,978	$73,683	$61,740	6,367
Age 41-45	$25,565	$21,006	$32,161	$26,324	$78,736	$64,680	6,755
Age 46-50	$26,944	$22,453	$34,554	$28,353	$78,065	$64,190	7,335
Age 50-55	$28,794	$23,538	$36,484	$29,288	$80,052	$64,622	8,317
Age 56-60	$28,514	$23,637	$35,059	$28,352	$69,698	$53,018	7,640
Age 61-65	$28,451	$23,132	$33,279	$26,920	$51,864	$38,400	6,745
Age 66+	$27,670	$22,976	$31,075	$24,297	$27,627	$7,840	13,703

*Note*s: Data from the 2011 through 2016 public-use microdata Consumer Expenditures Survey (CEX) interview panel. Panel A includes CEX consumption units (CUs) with a college student between the ages of 18 and 24, Panel B includes CEX CUs in which either the reference person or their spouse had attended college but not received a bachelor's degree (48 percent of CUs) or had attended college and received a bachelor's degree (52% of CUs) and fell within the specified age range. Consumption is equal to total expenditures minus expenditures on education, household production, pensions, retirement accounts, and personal insurance, gifts, transfers, and contributions to charities, medical expenses, and health insurance, and expenditures on owned housing (mortgage, mortgage interest, maintenance and repairs) plus the rental value of owned housing. Consumption and total expenditures are adjusted based on CU size, where the adjustment factor equals $(adults + 0.7 * children)^{0.7}$. All dollar amounts are adjusted for inflation (2013$). Means and medians are calculated using CEX weights.

Table C.14: Mean Marginal Utility of Consumption for Current and Former Students by Risk Aversion

	Mean marginal utility*100,000			Observations
Gamma =	*1*	*2*	*3*	
A. Attending college, age 18-24				
Full sample	70.73	0.0066	7.876E-07	11,397
All with AGI	71.10	0.0066	7.813E-07	5,579
AGI $10k-$30k	80.87	0.0079	9.110E-07	1,271
AGI $30k-$50k	70.47	0.0059	5.685E-07	912
B. College educated, age 25-30				
Nationally representative	56.61	0.0041	3.735E-07	7,178
Reweighted (TX sample attainment)	58.01	0.0043	3.976E-07	7,178

*Note*s: Data from the 2011 through 2016 public-use microdata Consumer Expenditures Survey (CEX) interview panel. Panel A includes CEX consumption units (CUs) with a college student between the ages of 18 and 24, Panel B includes CEX CUs in which either the reference person or their spouse had attended college but not received a bachelor's degree or had attended college and received a bachelor's degree and was between 25 and 30 years old. Nationally representative = based on attainment in CEX (52 percent with BA, 48 percent with some college). Reweighted to represent attainment in the Texas sample uses weights calculated by raking to fit the share of the Texas analysis sample that has a bachelor's degree 7 years after college entry (44 percent). Marginal utility = consumption$^{-\gamma}$ where the value of gamma (coefficient of relative risk aversion) is specified in column headings. See Appendix Table C.11 for definition of consumption.

Table C.15: Direct Utility Gain from $1 Increase in Grant Aid, Allowing for Consumption Value of College

	Risk aversion parameter (γ) = 1	2	3
A. All college students			
Net discount rate ($R\beta$) =			
1.03	[-0.02, -0.01]	[0.17, 0.21]	[0.41, 0.52]
1	[0.17, 0.18]	[0.40, 0.45]	[0.69, 0.81]
0.97	[0.409, 0.413]	[0.68, 0.74]	[1.02, 1.18]
B. Low AGI college students			
Net discount rate ($R\beta$) =			
1.03	[0.05, 0.12]	[0.34, 0.56]	[0.74, 1.22]
1	[0.25, 0.34]	[0.60, 0.86]	[1.08, 1.65]
0.97	[0.51, 0.60]	[0.93, 1.24]	[1.50, 2.18]
C. High AGI college students			
Net discount rate ($R\beta$) =			
1.03	[-0.15, -0.13]	[-0.09, -0.08]	[-0.014, -0.010]
1	[0.02, 0.04]	[0.09, 0.10]	[0.177, 0.182]
0.97	[0.22, 0.25]	[0.30, 0.32]	[0.41, 0.42]

*Note*s: See Table 8 notes for sample and estimation details.

Appendix D: Applicability of Envelope Theorem

In this appendix, we show that our model, in which the fixed cost of attending college can create a kink in the value function, satisfies the conditions outlined by Clausen and Strub (2016) for applying the Envelope Theorem to the welfare maximization problem. Our concern is that the value function will generally be kinked at government policy values for which the student is indifferent between two choice vectors $(\mathbf{c}, \mathbf{s}, \mathbf{x})$, one of which has $s_t = 0$ while the other has $s_t > 0$. The theorem establishes that such policy values at which the value function is kinked will not be optimal, and therefore the value function's lack of differentiability at these points is of no concern. Intuitively, if we consider the upper envelope of two concave value functions (one with $s_t = 0$ and the other with $s_t > 0$) then the kink at their intersection will be an upward kink, with higher values on at least one side of the kink.

Theorem 1 of Clausen and Strub (2016) establishes that at any interior solution $\hat{p}$ to the value function $V(p)$: (a) the value function is differentiable, (b) its derivative is zero, and (c) all derivatives in the first-order condition exist. This holds if the value function is bounded above and below by two differentiable functions $U(p)$ and $L(p)$ with $V(\hat{p}) = L(\hat{p}) = U(\hat{p})$ and $L'(p) = U'(p) = 0$. An obvious choice for $U(p)$

is the constant $V(\hat{p})$, which by definition bounds $V(p)$ from above. There is also a straightforward choice for the function $L(p)$. To avoid rewriting the entire value function here we will simply define $h(\mathbf{c}, \mathbf{s}, \mathbf{x}|p)$ as its maximand and $(\hat{\mathbf{c}}, \hat{\mathbf{s}}, \hat{\mathbf{x}})$ as the maximizer for policy $\hat{p}$, i.e. $V(\hat{p}) = \max_{\mathbf{c},\mathbf{s},\mathbf{x}} h(\mathbf{c}, \mathbf{s}, \mathbf{x}|\hat{p}) = h(\hat{\mathbf{c}}, \hat{\mathbf{s}}, \hat{\mathbf{x}}|\hat{p})$. Define $L(p) = \max_{\mathbf{c}} h(\mathbf{c}, \hat{\mathbf{s}}, \hat{\mathbf{x}}|p)$ and note that $L(p) \leq V(p)$, $L(\hat{p}) = V(\hat{p})$, and $L'(p) = 0$. The value function is therefore "sandwiched" between these differentiable functions at the policy value $\hat{p}$.

Appendix E: Details for Welfare Evaluations in Other Settings

Our back-of-the-envelope calculations in Section 7.3 should be viewed as illustrative. The relevant parameters have not all been estimated, and we must make assumptions about impacts on long-run income and tax revenue and, in the case of Bettinger et al. (2016), the resource cost of educating students at different schools. We ignore non-fiscal externalities, which would likely improve the welfare effects of the grants that increase educational attainment. These calculations serve as a rough example of the parameters that empirical researchers can estimate, and how they can connect the estimates of various outcomes to obtain estimates of the welfare effects of changes in grants and tuition rates.

E.1 Grant aid provided to marginal Pell Grant recipients

Marx and Turner (forthcoming) study the effect of additional grant aid provided to students at the Pell Grant Program's eligibility threshold within the City University of New York (CUNY) system. Identification comes from a discontinuity in Pell Grant aid as a function of students' expected family contribution (EFC), the federal government's measure of ability to pay for college. Students at this threshold have higher family income – with an average AGI of approximately $48,000 – than students at the automatic zero EFC threshold. The approximately $400 increase in Pell Grant aid received by eligible students with EFCs below the eligibility threshold at entry led to a $33 increase in other grant aid ($p < 0.05$), a $224 decrease in borrowing through federal loan programs ($p < 0.01$), and no significant effects on college entry, choice of institution, or attainment (including persistence, credits attempted, credits earned, or GPA). These estimates are available in Table 3, Online Appendix Table B.8, Table 5, Table 4, and Table 8 of Marx and Turner (forthcoming).

For the purpose of welfare evaluation, the initial increase in Pell Grant aid is a transfer. The additional grant aid that is crowded-in represents an increase in social costs of $0.08 per dollar of Pell Grant aid. Accounting for the welfare implications of reduced borrowing requires additional assumptions, specifically, the fraction of the foregone loan dollars that would not have been repaid to the federal government. On average, 26 percent of Pell Grant recipients who attended a CUNY institution had either defaulted on

their loans or had failed to make a payment of at least $1 towards their loan debt five years after leaving college.[5] Under the assumption that this average also applies to the students studied by Marx and Turner (forthcoming) and that such borrowers fail to make further payments on their federal loans, we estimate that Pell Grant eligibility generated a $58 reduction in loan debt that would not have been repaid, representing a $0.15 reduction in social costs per $1 of Pell Grant aid. Thus, at least in the short-run, increases in Pell Grant generosity for students on the margin of eligibility would improve welfare by reducing social expenditures.

Taking into account the consumption-smoothing benefits from providing additional grant aid to middle-income students would generate larger net welfare benefits, in the range of $0.52 to $0.61 per $1 increase in Pell Grant aid (Table 8, Panel A with $\gamma = 2$ and $R\beta = 1$). Even using the lowest estimated direct effect of $0.03 in direct benefits per $1 increase in Pell Grant generosity, the reduction in borrowing would only have to generate a $0.05 reduction in social expenditures (corresponding to a loan repayment rate of more than 90 percent) for additional grant aid to improve welfare even without effects on educational attainment.

E.2 Cal Grant eligibility thresholds

In our second example, Bettinger et al. (2016) examine the short- and long-run effects of the Cal Grant Program on college choice, degree receipt, and earnings. The program covers tuition and fees at four-year public institutions and heavily subsidizes tuition at four-year nonprofit schools. Cal Grant eligibility requirements generate two discontinuities based on income and high school GPA. At the income eligibility threshold, students have relatively high income and GPAs (approximately $60,000 and 3.55), while at the GPA threshold, students come from relatively low-income families and have lower GPAs (approximately $35,000 and 3.08). Table 1 of Bettinger et al. (2016) displays these characteristics.

At the income threshold, eligibility has no significant effect on the probability of college enrollment (Table 2), number of years spent in college (Figure A6), log labor income or log AGI 10 to 14 years after Cal Grant application (Table 3). Eligibility did have significant effects on choice of institution, leading students to select out of public institutions and into private institutions (Table 2).

At the income threshold, indirect welfare effects will be limited to changes in the social cost of educating students who were induced to switch between higher education sectors. Switches from public into nonprofit schools generate two fiscal externalities: changes in the public subsidy to the institution attended, and increases in the amount of Cal Grant payments relative to what would have been paid if students did not switch, as the grant is larger for students in private four-year institutions. The second externality arises from changes to public subsidies that are provided directly to institutions.

[5]The loan (non)repayment rate of 26 percent for Pell Grant recipients comes from the 2014-15 College Scorecard institution-level data (available at: https://collegescorecard.ed.gov/data/) and represents a loan repayment rates for federal borrowers who entered repayment in FY 2009 or FY 2010.

For simplicity, we assume that grants provided to four-year public school students equaled average tuition ($2500) and that average grant aid received by private-school attendees equaled the reported maximum amount available at these schools ($9388). To approximate the average Cal Grant received by eligible students at the income threshold, we take the average of tuition at the California State University and University of California school systems for students attending public four-year schools and the average grant available at private schools (see page 7 of Bettinger et al. (2016)). We assume that marginal Cal Grant recipients are evenly split between public and private schools and that the average student obtains three years of schooling, which generates estimated average total Cal Grant aid received by marginal students equal to $9129, matching the reported results. Shifting the shares of public- and private-attending students by the reported effect sizes suggests that of the $8129 change in grants at the threshold, $1218 was a negative externality due to endogenous responses.

The net per-student subsidy provided to higher education institutions in California is calculated using data from the IPEDS finance survey. Specifically, this subsidy equals the difference between core expenditures on instruction, student services, and academic support and private tuition payments. From the IPEDS, we estimate that the net per-student-year subsidy at four-year institutions in California is nearly the same in the public and private sectors and substantially lower for community colleges. The externality due to shifting students away from the two-year to the four-year sector using the average difference in the per-student subsidy of $9769. Multiplied by the share of students induced to leave community colleges (0.035) and an average of three years of schooling gives a fiscal externality of -$1026. The sum of the two fiscal externalities is -$3244 or -$0.47 per $1 increase in grant generosity.

For the direct welfare gains, we use the estimate for high-income students (Table 8, Panel C, $\gamma = 2$, $R\beta = 1$), which suggests a benefit of $0.16 to $0.33 per $1 increase in grant aid generosity. For this value of the direct effect and our back-of-the-envelope calculations of net fiscal externalities, we conclude that the welfare effects of increasing grant aid at this margin are negative, on the order of -$0.14 to -$0.31 per $1 increase in grant generosity.

In the case of the Cal Grant GPA eligibility threshold, the authors find insignificant effects of eligibility on college attendance or choice of institution (Table 2), increased years of enrollment (discussed on page 17), and increases in log labor income and AGI 10 to 14 years after application (Table 2). Thus, at the GPA threshold, indirect welfare effects come from changes in social costs due to additional years of college attendance and increases in tax revenue paid by eligible students who experience earnings gains.

The average per-student subsidy to California four-year institutions (weighted by the enrollment proportions of 0.57 in public and 0.12 in private in this population at entry) is $13,172 per year. With eligible students obtaining an additional 0.08 years of education, this amounts to a $1054 increase in social costs.

The additional Cal Grant aid received by eligible students is displayed in Table 2. Scaled by the average per-student subsidy suggests a $0.24 increase in social costs per $1 increase in Cal Grant generosity.

The increase in log AGI at the GPA eligibility threshold equals 0.01 (Table 3) or $469 more than the exponentiated control group mean ($46,630). To estimate the increased tax revenue from eligible students' earnings gains, we assume the annual AGI increase of $469 accrues in each year of a 35-year career and is taxed at the 8 percent rate that we obtain for our low-income Texas sample. Under these assumptions, we estimate that the positive fiscal externality is $0.30 per $1 of Cal Grant aid. Thus, even if students perfectly smooth consumption, these calculations suggest that increases in grant generosity for students at the GPA threshold for Cal Grant eligibility would increase welfare. This calculation should be viewed with extra caution, however, as it relies on a statistically-insignificant effect on AGI.

Even with negative net externalities, direct benefits to students at the GPA threshold would likely ensure a welfare gain. Mean family income at the time of application was $35,100. The lower bound for our middle estimate of the direct effect for low-income college students in Table 8 is 0.67. For net externalities in the range of -0.67, the effect on log AGI would need to be lower than the reported estimate by nearly two times its standard error.

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