Borrowing Trouble? Student Loans, the Cost of Borrowing, and Implications for the Effectiveness of Need-Based Grant Aid

Online Appendix: Not for Publication

A   CUNY and Federal Student Aid Programs

In this section, we provide additional information on the CUNY system and schools and the parameters of federal student aid programs during our sample period.

A.1   CUNY

We distinguish between community colleges and four-year colleges in the CUNY system. Community colleges include Borough of Manhattan Community College (BMCC), Bronx Community College, Hostos Community College, Kingsborough Community College, LaGuardia Community College, and Queensborough Community College. Four-year colleges include Baruch College, Brooklyn College, City College of New York, College of Staten Island, Hunter College, John Jay College of Criminal Justice, Lehman College, Medgar Evers College, New York City College of Technology (NYCCT), Queens College, and York College. However, several of CUNY's four-year ("senior") colleges offer both associates' and bachelors' degrees (College of Staten Island, John Jay, Medgar Evers, NYCCT, and York College). All of CUNY's community colleges only offer associates' degrees.

CUNY tuition and the range of fees, estimated living expenses, and total cost of attendance faced by full-time, full-year, in-state CUNY students during the years we examine are displayed below in Table A.1. Cost of Attendance (COA) equals allowable living expenses include the cost of books and supplies, room and board, transportation expenses, miscellaneous personal expenses, and dependent care, when applicable. Estimated living expenses depend on a students' planned housing. Within institutions, students within the same broad category (e.g., full-time freshmen living off campus) are all classified as having the same COA, even if actual living expenses vary substantially across individuals within a given group.

Table A.1: Parameters of CUNY System Institutions: 2006-07 through 2011-12

Nominal Annual Expenses	Two-year CUNY colleges	Four-year CUNY colleges
Tuition, 2006-07 through 2008-09	$2,800	$4,000
Tuition, 2009-10	$3,150	$4,600
Tuition, 2010-11	$3,600	$5,130
Fees	$268 - $355	$252 - $477
Books and supplies	$879 - $1,146	$879 - $1,146
Living expenses (off campus)	$5,905 - $6,568	$5,905 - $6,568
Living expenses (with family)	$12,916 - $16,231	$12,916 - $16,231
Total cost of attendance	$9,852 - $21,332	$11,036 - $22,984

A.2   Federal Pell Grant Program

Table A.2 displays the minimum and maximum (nominal) Pell Grant awards and Pell Grant eligibility threshold during the years we examine. The relationship between EFC and Pell Grant aid for students eligible for an award that is greater than the minimum and less than the maximum does not vary over the years we examine. As long as a student's COA is greater than her statutory Pell Grant, Pell Grant aid only depends on EFC. For most CUNY students, this constraint is not binding.

Table A.2: Parameters of the Pell Grant Program: 2006-07 through 2010-11

	2006-07	2007-08	2008-09	2009-10	2010-11
Minimum Pell Grant	$400	$400	$890	$976	$555
Maximum Pell Grant	$4,050	$4,310	$4,731	$5,350	$5,550
Eligibility threshold (EFC)	$3,850	$4,110	$4,041	$4,617	$5,273

Students with a zero EFC receive the maximum Pell Grant award. For the 2006-07 through 2008-09 academic years, dependent students and independent students with children would automatically receive a $0 EFC if their family income fell below $20,000 and their parents either received means tested benefits during the year or were eligible to file a simplified tax return (indicating low assets). In 2010, the income limit was raised to $30,000.[1]

A.3   Federal Direct Loans

Prior to 2010, schools participated in one of two parallel federal lending programs: the William D. Ford Federal Direct Loan Program and the Federal Family Education Loan (FFEL) Program, through which the federal government guaranteed loans originated by private lenders. The 2010 Health Care and Education Reconciliation Act abolished the FFEL program. This reform did not affect CUNY students because CUNY schools were already participating in Direct Loan Program prior to 2010. Students pay an origination

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[1]See http://www.ifap.ed.gov/eannouncements/attachments/0708EFCFormulaGuide.pdf and http://www.ifap.ed.gov/efcformulaguide/attachments/111408EFCFormulaGuide0910.pdf for further details.

fee when taking out federal loan aid, but this fee is continuous in the amount borrowed (approximately 1 percent).

Borrowing limits vary slightly over our sample period. Prior to fall 2007, first-year, dependent students could borrow a maximum of $2,625 in subsidized federal loans. Prior to fall 2008, dependent students were not eligible to borrow above the subsidized limit and independent students were allowed to borrow an additional $4,000 in unsubsidized loans. Students who are considered to be in their second year for federal loan eligibility purposes (i.e., those who have accumulated between 30 and 59 credits) with unmet need can borrow up to $4,500 in subsidized loans ($3,500 prior to fall 2007), 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. Regardless of credits accumulated, students in two-year degree programs are never considered to be third year students for federal borrowing purposes. 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). 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 eligibility is limited to be no more than the total cost of attendance minus other financial assistance and subsidized loans (e.g., unsubsidized loans can be used to replace EFC). This latter constraint is rarely binding.

Appendix B: Additional Figures and Tables

Figure B.1: Sample CUNY Financial Aid Award Letter

Figure B.2: Sample CUNY Loan Application Form

Academic Year: 2013-2014

Summer 2013
Fall 2013
Spring 2014

HUNTER
City University of New York
695 Park Avenue: New York, NY 10065
Office of Financial Aid
Room 241 North
Tele.: 212-772-4820

WILLIAM D. FORD FEDERAL DIRECT STAFFORD LOAN APPLICATION

(Please **print clearly** in BLACK or BLUE ink)
Incomplete applications will not be processed

Student's Information:

Last Name: _____ First Name: _____ Middle Initial: _____

SS#: _____/_____/_____ Date of Birth: _____/_____/_____

Permanent Address: (*P.O. boxes or dorm addresses CANNOT be used as a permanent address)

Street: _____ Apt#: _____

City, State: _____ Zip Code: _____

Mailing Address, if different from permanent address:

Street: _____ Apt#: _____

City, State: _____ Zip Code: _____

Phone #: (_____) _____ Hunter E-mail Address: _____ @hunter.cuny.edu

All loans will be disbursed in two (2) equal payments, Fall 2013 and Spring 2014. If the student is eligible for a Summer 2013 loan and he/she indicates that they would like to be considered for a Summer disbursement, the loan will be disbursed in three (3) payments, instead of two.
**One (1) semester loans will only be processed for graduating students.

I am registered for at least 6 credits during the Summer 2013 semester.	☐ Yes ☐ No	**Undergraduates Only**: I would like this loan for Summer 2013 only, because I am anticipating Financial Aid for Fall 2013 & Spring 2014. ☐ Yes ☐ No
If yes: I would like to be considered for a Summer loan disbursement.	☐ Yes ☐ No	

I am graduating at the end of the following semester: ☐ Summer 2013 ☐ Fall 2013 ☐ Spring 2014
☐ I am not graduating during the 2013 – 2014 academic year

Total loan amount requested for the 2013-2014 academic year:
You must round the amount to the nearest whole dollar.

$ .00

Undergraduates:
I understand that I will be considered for a SUBSIDIZED loan first. ☒ Yes
If I am not eligible for a subsidized loan, I authorize the Office of Financial Aid to process an UNSUBSIDIZED loan. ☐ Yes ☐ No

Graduates:
I understand that Graduate students are no longer eligible for subsidized loans. I authorize the Office of Financial Aid to process an UNSUBSIDIZED loan. ☐ Yes

UNDERGRADUATE STUDENTS: Will you be pursuing your first Bachelor's degree during the 2013-14 academic year? ☐ Yes ☐ No

Borrower's Certification: My signature below certifies that I am aware I must be making Satisfactory Academic Progress in order to receive the Federal Direct Stafford Loan(s) I am applying for. I must complete and sign a Master Promissory Note, if I am required to do so. I also understand that if I have not completed the required steps listed on theright of this application, my loan *will not* be processed. I understand that it is my responsibility to follow up on the status of my loan application if I do not receive notification. I am also aware that my attendance must be verified by the Office of Financial Aid, before a disbursement is made in accordance with the Financial Aid 'Schedule of Payments'.

Applicant's signature: _____ **Date:** _____

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Undergraduate Annual Loan Limits and Rates

Crds Completed	Dependent	Independent
0 – 29.9	$5,500 (Max. Subsidized= $3,500)	$9,500 (Max. Subsidized= $3,500)
30 – 59.9	$6,500 (Max. Subsidized= $4,500)	$10,500 (Max. Subsidized= $4,500)
60+	$7,500 (Max. Subsidized= $5,500)	$12,500 (Max. Subsidized= $5,500)

Subsidized interest rate: 6.8% fixed (disbursed on or after July 1st, 2013 and prior to July 1st, 2014)
Unsubsidized interest rate: 6.8% fixed (disbursed on or after July 1st, 2006)

Graduate Annual Loan Limits and Rates

$20, 500

Unsubsidized interest rate: 6.8% fixed (disbursed on or after July 1st, 2006)

**Effective for loan disbursements beginning on or after July 1st, 2012, graduate and professional students are no longer eligible to receive Direct Subsidized Loans. Direct Subsidized Loans disbursed prior to the 2012-2013 academic year are not affected by this change.

REQUIREMENTS:
The following 4 criteria are REQUIRED in order for the Office of Financial Aid to process your loan within 15 business days. When your application is reviewed and the 4 criteria have not been completed, your application will not be processed. The Office of Financial Aid will NOT return any incomplete applications. Check with the Office of Financial Aid after 15 business days to follow up on your application status.

☐ Have a valid 2013-2014 FAFSA Application (www.FAFSA.ED.GOV)

☐ Must be a matriculated student, registered for at least 6 credits, within your grade level, per semester during the 2013-2014 academic year

☐ Complete an 'Entrance Counseling' quiz** (www.STUDENTLOANS.GOV)
* You must attach the confirmation page

☐ Complete a Master Promissory Note (MPN) ** (www.STUDENTLOANS.GOV)

**Your loan request will be applied to your CUNYfirst account within 15 business days or less.

LOAN ELIGIBILITY DETERMINATION:
The approved loan amount will be determined by CUNY's Cost of Attendance (COA), minus the Expected Family Contribution (EFC), which is determined by your FAFSA application for 2013-2014. Any financial aid and scholarships you are awarded will be deducted from your COA.

NOTIFICATION:
Once your loan is processed you should receive an award notification, by mail, from CUNY's University Application Processing Center. If there are any discrepancies on your award notification, you must contact the Office of Financial Aid immediately. Once a disbursement has occurred, you will receive a disclosure statement from the loan servicing agency.

REFUND:
Check Hunter College's 'Schedule of Payments' for loan disbursement dates. Refunds are mailed by check or you can sign up for Direct Deposit, visit www.hunter.cuny.edu/finaid to print the form. **Direct Deposit is strongly encouraged** because you will get your funds on the same day of disbursement. If your check is mailed, you will get it 3 or 5 days later depending on your local post office. If checks are lost via mail it will take about 4 weeks or longer for you to get a replacement check.

****Note to Transfer Students:** Your 2013-2014 annual loan limit may be affected if you borrowed loans at another institution for Summer 2013 and/or Fall 2013.

*Note*s: Available at http://www.hunter.cuny.edu/onestop/finances/financial-aid/.

Figure B.3: The Empirical Distribution of Pell Grant Aid by Distance to Eligibility Threshold: Returning Students
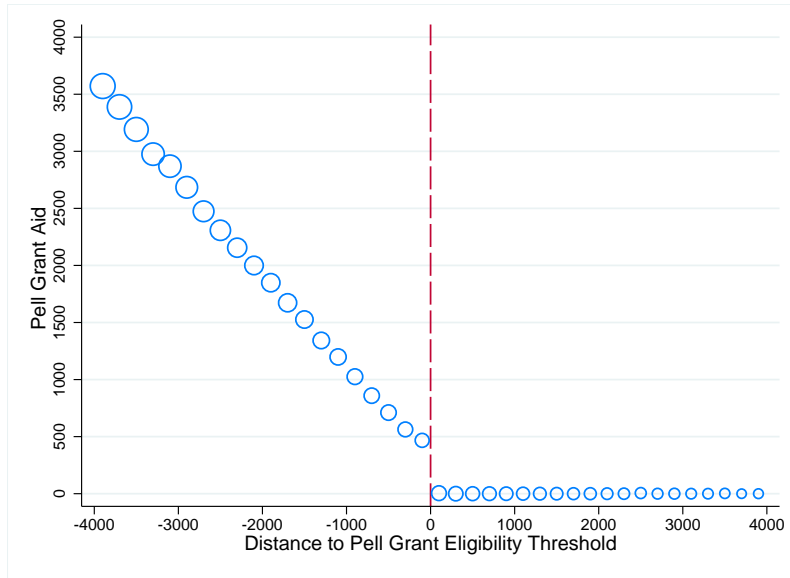
Notes: Second- and third-year CUNY undergraduate degree-seeking students; 2005 through 2010 cohorts. $200 EFC bins. Each circle represents the average Pell Grant aid received by students in the bin. Larger circles represent a larger underlying sample size. All dollar amounts adjusted to represent constant 2012$.

Figure B.4: The Density of EFC at the Pell Grant Eligibility Threshold: Returning Students
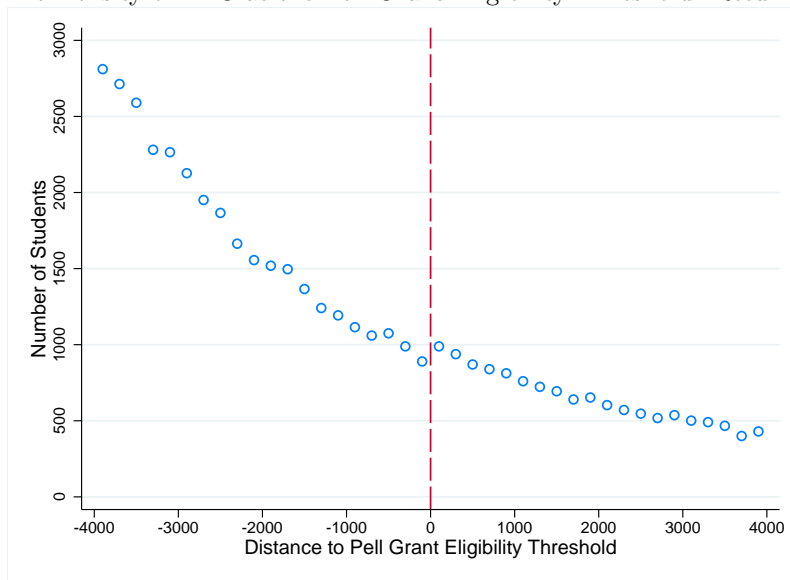
Notes: Second- and third-year CUNY undergraduate degree-seeking students; 2005 through 2010 cohorts. $200 EFC bins. Each circle represents the total number of students in the bin. All dollar amounts adjusted to represent constant 2012$.

Figure B.5: The Reduced Form Impact of Pell Grant Eligibility and Generosity on Total Borrowing: Returning Students

*Note*s: Second- and third-year CUNY undergraduate degree-seeking students; 2005 through 2010 cohorts. $200 EFC bins. Each circle represents average loan aid (subsidized + unsubsidized Federal Direct Loans) received by students in a given bin. Larger circles represent a larger underlying sample size. All dollar amounts adjusted to represent constant 2012$.

Figure B.6: Impacts on Overall Borrowing Driven by a Reduction in Subsidized Borrowing

*Note*s: First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. $200 EFC bins. Each circle represents average subsidized (A) or unsubsidized (B) Federal Direct Loan aid received by students in the bin. Larger circles represent a larger underlying sample size. All dollar amounts adjusted to represent constant 2012$.

Figure B.7: Reduced Form Impacts of Pell Grant Aid on Educational Outcomes

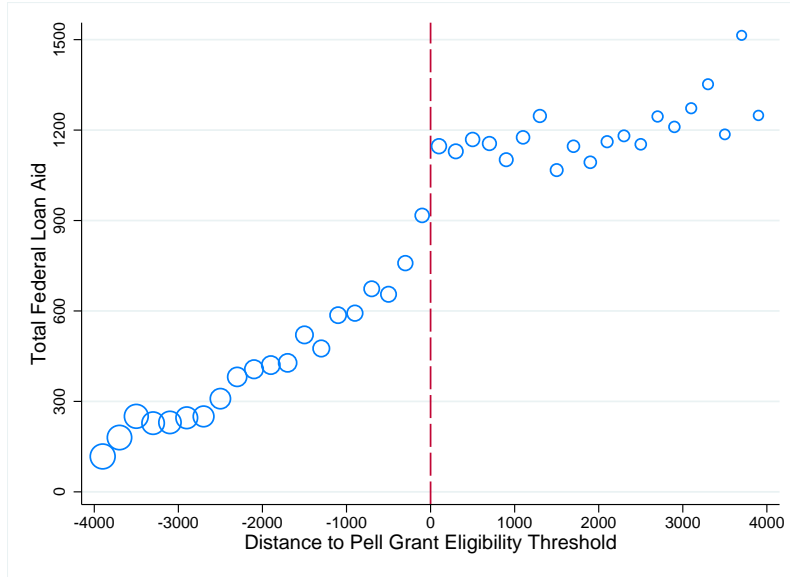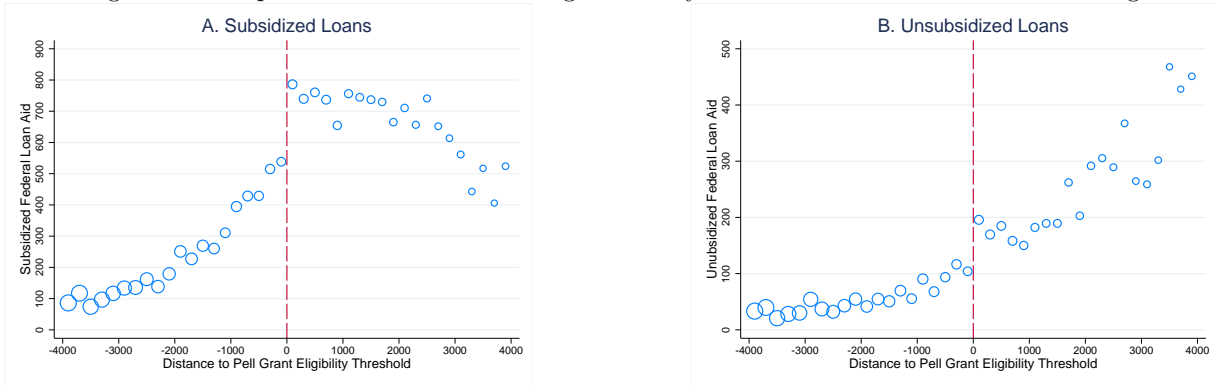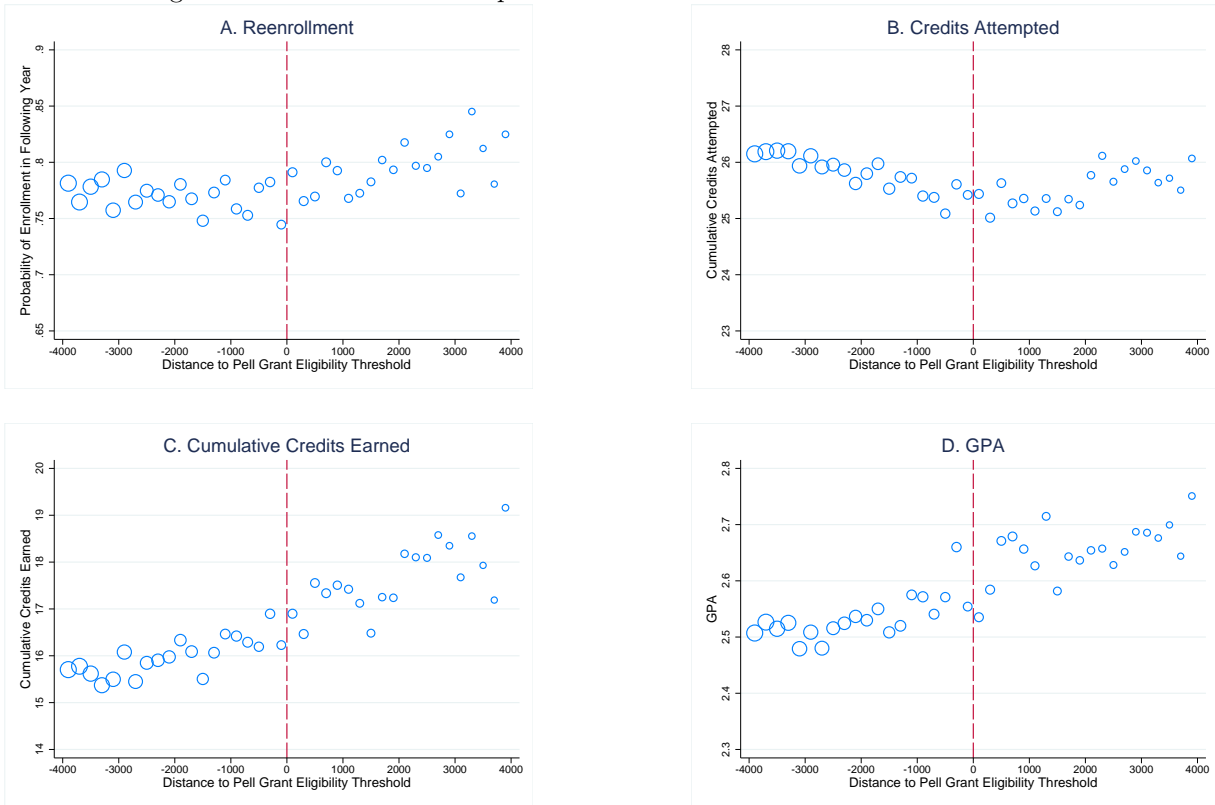*Notes:* First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. $200 EFC bins. Each circle represents the average probability of enrolling in the following year (A), average credits attempted including credit equivalents from remedial courses (B), average credits earned (C), and average GPA (D) among currently enrolled students. Larger circles represent a larger underlying sample size.

Figure B.8: Actual and Counterfactual Cumulative Distribution of Loans
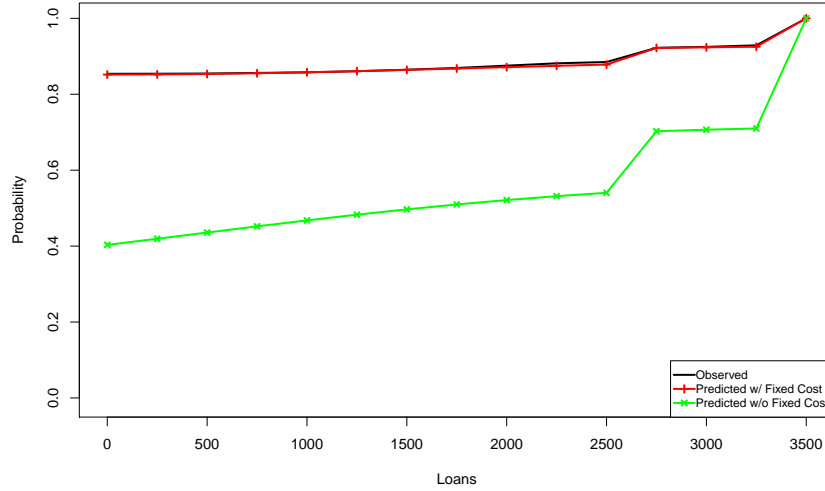
*Note*s: First-year CUNY undergraduate degree seeking students subject to the exogenous subsidized loan limit; 2007 through 2011 cohorts. $500 EFC bins. The solid black line indicates the share of students with loan debt at or below the indicated level. Red plus markers represent predictions from the maximum likelihood model. Green X markers represent predicted borrowing predictions with no fixed cost of borrowing. All dollar amounts adjusted to represent constant 2012$.

Figure B.9: Cumulative Distribution of Borrowing Thresholds
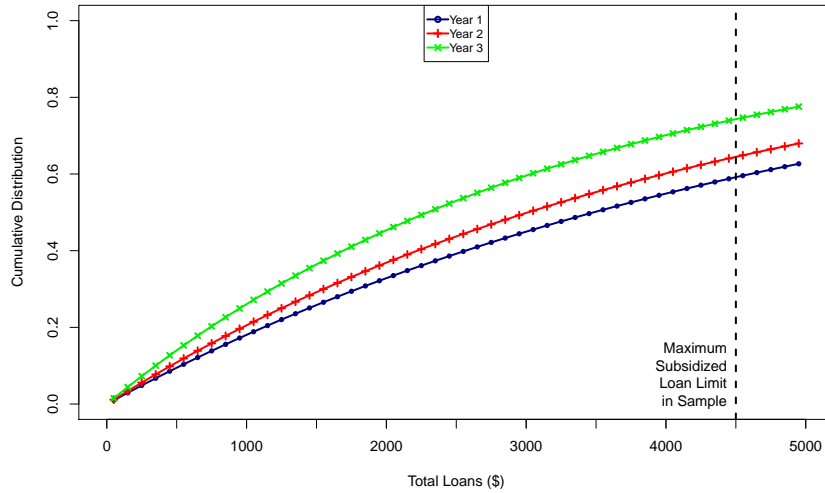
*Note*s: Estimated distribution of borrowing thresholds (below which observed borrowing is set to zero). See Section 7 of the main text for model and estimation details.

Figure B.10: Reduced Form Impacts of Pell Grant Aid on Borrowing: NPSAS Sample
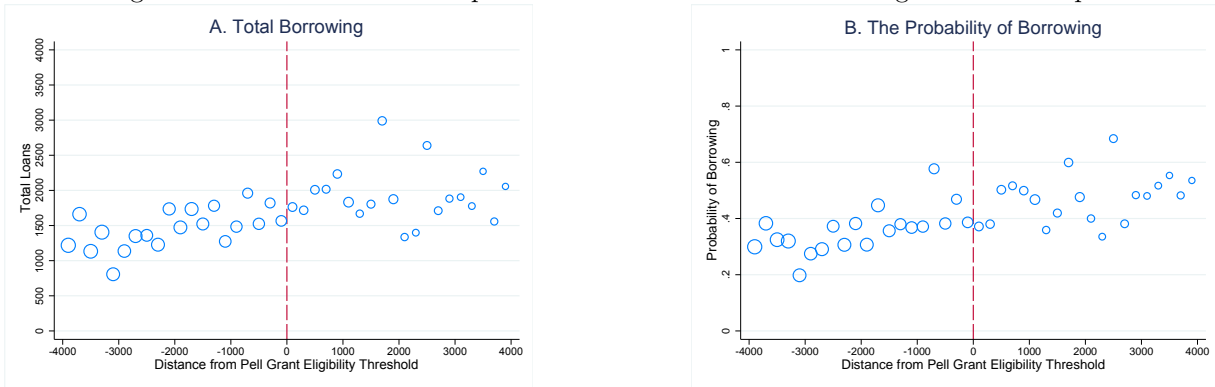
Notes: First-year undergraduate degree-seeking students attending public two- and four-year schools in 2008 National Postsecondary Student Aid Studies (NPSAS). $200 EFC bins. Each circle represents the average federal loans (Panel A) or probability of borrowing (Panel B) among students in the bin. All dollar amounts adjusted to represent constant 2012$.

Table B.1: The Relationship between Pell Grant Eligibility and Predetermined Characteristics

	(1) White	(2) Female	(3) Dependent	(4) Immigrant	(5) Age	(6) AGI	(7) College Ed Parent(s)
A. First-year students							
Pell Grant eligible	-0.002	-0.004	0.002	0.035	-0.012	-1150	-0.010
	(0.009)	(0.012)	(0.006)	(0.031)	(0.112)	(553)*	(0.011)
× Distance from threshold	-0.00005	-0.000001	0.000007	-0.00005	-0.0001	-1.06	0.000001
	(0.00005)	(0.000005)	(0.000002)**	(0.0001)	(0.0001)	(0.78)	(0.000004)
Test of joint sig: p-value	0.517	0.864	0.014	0.490	0.755	0.019	0.639
Polynomial degree	1	1	1	4	2	2	1
Observations	38,100	38,100	38,100	38,100	38,100	38,100	35,011
B. Returning students							
Pell Grant eligible	-0.004	0.013	-0.009	0.024	0.015	-1561	-0.002
	(0.010)	(0.010)	(0.006)	(0.017)	(0.073)	(658)*	(0.028)
× Distance from threshold	-0.000003	0.00001	0.000004	-0.000003	-0.00005	-0.78	0.00004
	(0.000004)	(0.000004)	(0.000003)	(0.00002)	(0.00003)	(1.58)	(0.0001)
Test of joint sig: p-value	0.669	0.101	0.202	0.368	0.340	0.048	0.889
Polynomial degree	1	1	1	2	1	3	4
Observations	46,744	46,744	46,744	46,744	46,744	46,744	43,347

*Note*s: First-, second-, and third-year CUNY undergraduate degree-seeking students; 2005 through 2011 cohorts. Observations missing information on parental education are excluded from the Column 7 sample. Each column within a panel represents estimates from a separate regression. Clustered standard errors (institution by year) in parentheses; ** p<0.01, * p<0.05, + p<0.1. All regressions also include controls for degree program (AA versus BA), school by year fixed effects, years since entry fixed effects, and a polynomial in student expected family contribution ($\widetilde{EFC}_{it} = EFC_{it} - efc_{0t}$, where efc_{0t} is the threshold for Pell Grant eligibility in year t), allowed to vary on either side of the eligibility threshold. The degree of polynomial is chosen to minimize the AIC. Students with EFC greater than $4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012$.

Table B.2: The Impact of Pell Grant Aid on Subsidized and Unsubsidized Borrowing

| | Subsidized Loans | | Unsubsidized Loans | |
	(1) First-Year Students	(2) Returning Students	(3) First-Year Students	(4) Returning Students
A. OLS Estimates				
Pell Grant eligible	-164.56	-209.01	-59.90	-64.98
	(42.03)**	(45.45)**	(22.96)*	(21.39)**
× Distance from threshold	0.235	0.259	0.059	0.076
	(0.054)**	(0.054)**	(0.032)+	(0.033)*
Observations	38,100	46,744	38,100	46,744
B. 2SLS Estimates				
Pell Grant aid	-0.333	-0.392	-0.094	-0.116
	(0.066)**	(0.071)**	(0.041)*	(0.042)**
Observations	38,100	46,744	38,100	46,744

*Note*s: The sample in Columns 1 and 3 includes first-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. The sample in Columns 2 and 4 includes second-, and third-year CUNY undergraduate degree-seeking students; 2005 through 2011 cohorts. Each column within a panel contains estimates from a separate regression. Clustered standard errors (institution by year) in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$. All regressions also include controls for age, family AGI, and indicators for race (white versus nonwhite), dependency status (dependent versus independent), parents' highest level of education (college, high school, or less than high school), level of attendance (for federal loan eligibility purposes), degree program (AA versus BA), school by year fixed effects, years since entry fixed effects, and a quadratic in student expected family contribution ($\widetilde{EFC}_{it} = EFC_{it} - efc_{0t}$, where efc_{0t} is the threshold for Pell Grant eligibility in year t), allowed to vary on either side of the eligibility threshold. Excluded instruments in Panel B are $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and $\widetilde{EFC}_{it} \times \mathbf{1}[\widetilde{EFC}_{it} < 0]$. Students with EFC greater than \$4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012\$.

Table B.3: The Impact of Pell Grant Aid on Cumulative Financial Aid Received Three Years After Entry

	(1) Cumulative Pell Grant aid	(2) Cumulative loans aid	(3) Cumulative subsidized loans	(4) Cumulative unsub. loans
First year Pell Grant aid	1.189	-0.574	-0.402	-0.173
	(0.128)**	(0.226)*	(0.149)**	(0.109)
Mean	\$4,310	\$1,004	\$707	\$297
Observations	32,271	32,271	32,271	32,271

*Note*s: First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Each column contains estimates from a separate regression. The dependent variable is cumulative financial aid in the specified category received during a students' first three years (not conditioned on enrollment in years 2 and 3). Clustered standard errors (institution by year) in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$. See Table B.2 notes for a list of additional controls and excluded instruments. Students with EFC greater than \$4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012\$.

Table B.4: The Impact of Pell Grant Aid on Other Sources of Grant Aid

	(1) First-year students	(2) Returning students
A. Impacts on TAP Grant Aid		
Pell Grant Aid	0.051	0.044
	(0.046)	(0.048)
Observations	38,100	46,744
B. Impacts on Other Grant Aid		
Pell Grant Aid	0.084	-0.013
	(0.034)*	(0.050)
Observations	38,100	46,744

*Note*s: 2SLS estimates of the impact of Pell Grant aid on other grant aid. Column 1 sample includes first-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Column 2 sample includes second-, and third-year CUNY undergraduate degree-seeking students; 2005 through 2011 cohorts. Each column within a panel contains estimates from a separate regression. Panel A dependent variable is New York State Tuition Assistance Program (TAP) Grant aid. Panel B dependent variable is total grant aid less TAP and Pell Grant aid. Clustered standard errors (institution by year) in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$. See Table B.2 notes for a list of additional controls and excluded instruments. Students with EFC greater than \$4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012\$.

Table B.5: The Impact of Pell Grant Aid on Borrowing:
Robustness to Varying Bandwidths and Polynomials

Bandwidth:	$4,000	$3,000	$2,000	$1,000
Polynomial of order:				
One	-0.134	-0.187	-0.320	-0.665
	(0.023)**	(0.037)**	(0.057)**	(0.142)**
	[0.000]	[0.000]	[0.038]	[0.601]
Two	-0.428	-0.557	-0.706	-0.684
	(0.092)**	(0.109)**	(0.169)**	(0.247)**
	[0.116]	[0.867]	[0.875]	[0.779]
Three	-0.599	-0.814	-0.795	-0.771
	(0.148)**	(0.209)**	(0.243)**	(0.327)*
	[0.442]	[0.682]	[0.959]	[0.778]
Four	-0.910	-0.748	-0.773	-1.110
	(0.231)**	(0.254)**	(0.294)**	(0.392)**
	[0.930]	[0.987]	[0.992]	[0.999]
Optimal Order	2	1	1	2
Observations	38,100	25,613	15,645	7,523

*Note*s: First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Each cell represents a separate regression. Standard errors clustered at institution level in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$. All regressions include controls for age, family AGI, and indicators for race (white versus nonwhite), dependency status (dependent versus independent), parents' highest level of education (college, high school, or less than high school), level of attendance (for federal loan eligibility purposes), degree program (AA versus BA), school by year fixed effects, and a polynomial in student expected family contribution ($\widetilde{EFC}_{it} = EFC_{it} - efc_{0t}$, where efc_{0t} is the threshold for Pell Grant eligibility in year t), allowed to vary on either side of the eligibility threshold. Degree of polynomial is indicated in the first column. Optimal order of polynomial chosen using Akaike Information Criterion. Square brackets include p-values from test of joint significance of $200 EFC bin dummies included as additional regressors. Excluded instruments are $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and $\widetilde{EFC}_{it} \times \mathbf{1}[\widetilde{EFC}_{it} < 0]$. Students with EFC greater than the indicated distance from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012$.

Table B.6: The Impact of Pell Grant Aid on Borrowing: Estimates from Local Linear Regressions

	OLS		2SLS		
	(1) FS	(2) RF	(3) RD	(4) RK	(5) RD/RK
A. Imbens-Kalyanaraman Optimal Bandwidth					
Pell Grant eligible	378.10	-277.63			
	(26.520**	(52.28**			
× Distance from threshold	-0.798	0.223			
	(0.014)**	(0.047)**			
Pell Grant aid			-0.759	-0.275	-0.321
			(0.142)**	(0.058)**	(0.058)**
Crowd-out | borrower			-3.112	-1.486	-1.332
			(0.479)**	(0.259)**	(0.178)**
H_0: crowd-out >-1, *p*-value			<0.001	0.030	0.031
Bandwidth	1,639	2,078	2,078	2,078	2,078
Observations	12,519	16,360	16,360	16,360	16,360
B. Fan-Gijbels Rule of Thumb Bandwidth					
Pell Grant eligible	379.20	-253.63			
	(25.52)**	(58.60)**			
× Distance from threshold	-0.767	0.336			
	(0.013)**	(0.091)**			
Pell Grant aid			-0.657	-0.429	-0.492
			(0.149)**	(0.114)**	(0.101)**
Crowd-out | borrower			-2.704	-2.223	-2.025
			(0.538)**	(0.469)**	(0.282)**
H_0: crowd-out >-1, *p*-value			<0.001	0.005	<0.001
Bandwidth	1,774	1,358	1,358	1,358	1,358
Observations	13,726	13,217	13,217	13,217	13,217
C. Ludwig-Miller Cross Validation Bandwidth					
Pell Grant eligible	451.50	-265.10			
	(28.96)**	(53.44)**			
× Distance from threshold	-0.329	0.229			
	(0.122)**	(0.053)**			
Pell Grant aid			-0.720	-0.281	-0.330
			(0.146)**	(0.065)**	(0.065)**
Crowd-out | borrower			-3.000	-1.503	-1.375
			(0.512)**	(0.299)**	(0.207)**
H_0: crowd-out >-1, *p*-value			<0.001	0.047	0.035
Bandwidth	283	1,942	1,942	1,942	1,942
Observations	2,046	15,150	15,150	15,150	15,150

Notes: Estimates from local linear regressions of Pell Grant aid and loan aid on Pell Grant eligibility and generosity (OLS estimates) and loan aid on Pell Grant aid (2SLS estimates) using a uniform kernel. First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Each column within a panel represents a separate regression. Standard errors clustered at institution by year level in parentheses; ** p<0.01, * p<0.05, + p<0.1. See main text for description of bandwidth selection procedures.

Table B.7: Heterogeneity in the Impact of Pell Grant Aid on Borrowing: Returning Students

Student has characteristic:	(1) Immigrant		(2) Dependent Student		(3) College Educated Parent		(4) Attending Community College	
	N	Y	N	Y	N	Y	N	Y
A. Dependent Var = Total Loans								
Pell Grant Aid	-0.584	-0.420	-0.240	-0.522	-0.496	-0.471	-0.593	-0.250
	(0.145)**	(0.131)**	(0.465)	(0.098)**	(0.164)**	(0.122)**	(0.116)**	(0.135)+
Test of eq: p- value	0.413		0.561		0.901		0.055	
Crowd-out | borrower	-1.922	-1.806	-0.869	-1.973	-1.937	-1.694	-2.136	-1.062
	(0.359)**	(0.436)**	(1.479)	(0.268)**	(0.505)**	(0.360)**	(0.272)**	(0.594)+
H_0: crowd-out > -1, p -value	0.005	0.032	--	<0.001	0.032	0.027	<0.001	0.458
Test of eq: p- value	0.951		0.806		0.890		0.597	
Observations	46,744		46,744		43,347		46,744	
B. Dependent Var = Credits Earned								
Pell Grant Aid ($1k)	0.052	0.863	2.021	0.379	0.071	0.848	0.153	1.420
	(0.556)	(0.527)	(1.298)	(0.376)	(0.562)	(0.476)+	(0.395)	(0.853)+
Test of eq: p- value	0.303		0.211		0.263		0.178	
Observations	46,744		46,744		43,347		46,744	

*Note*s: 2SLS estimates of the impact of an additional dollar of Pell Grant aid on borrowing for all students and borrowing among students who would have borrowed in the absence of the increase in Pell Grant aid (Panel A) or credits earned during academic year (Panel B). Second- and third-year CUNY undergraduate degree-seeking students; 2005 through 2011 entry cohorts. Each column within a panel represents estimates from a separate regression. Clustered standard errors (institution by year) in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Table B.2 notes for a list of additional controls. All covariates are fully interacted with indicator for whether a student is a first- or second-generation immigrant (Column 1 specification), is a dependent student (Column 2 specification), has a college educated parent (Column 3 specification), or is attending a community college (Column 4 specification). Excluded instruments are $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and $\widetilde{EFC}_{it} \times \mathbf{1}[\widetilde{EFC}_{it} < 0]$ interacted with indicator for having the listed characteristic. Students with EFC greater than $4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012$.

Table B.8: Heterogeneity in the Impacts of Pell Grant Aid by TAP Grant receipt and Minimum Pell Grant: First-Year Students

	1. Any TAP Grant		2. High Minimum Pell	
	N	Y	N	Y
A. Dependent Var = Total Loans				
Pell Grant Aid	-0.775	-0.352	-0.470	-0.419
	(0.274)**	(0.087)**	(0.115)**	(0.134)**
Test of eq: *p*-value	0.138		0.77	
Crowd-out | borrower	-3.008	-1.571	-2.093	-1.683
	(0.813)**	(0.274)**	(0.358)**	(0.410)**
H_0: crowd-out > -1, *p*-value	0.007	0.018	0.001	0.048
Test of eq: *p*-value	0.596		0.828	
Observations	38,100		38,100	
B. Dependent Var = Credits Earned				
Pell Grant Aid ($1k)	-0.766	0.208	0.534	-0.162
	(0.886)	(0.428)	(0.611)	(0.498)
Test of eq: *p*-value	0.279		0.377	
Observations	38,100		38,100	

*Note*s: 2SLS estimates of the impact of an additional dollar of Pell Grant aid on borrowing for all students and borrowing among students who would have borrowed in the absence of the increase in Pell Grant aid (Panel A) or credits earned during academic year (Panel B). First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Each column within a represents a separate regression. Clustered standard errors (institution by year) in parentheses; ** p<0.01, * p<0.05, + p<0.1. High minimum Pell years are 2009 and 2010. See Table B.2 notes for a list of additional controls. All covariates are fully interacted with indicator for any TAP Grant received (column 1 specification) or high minimum Pell Grant (column 2 specification). Excluded instruments are $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and $\widetilde{EFC}_{it} \times \mathbf{1}[\widetilde{EFC}_{it} < 0]$. Students with EFC greater than $4,000 from Pell Grant eligibility threshold in their first year are excluded. All dollar amounts adjusted to represent constant 2012$.

Table B.9: Characteristics of Switchers

	E[X]	E[X|switcher]	$\beta = \dfrac{E[X\|switcher]}{E[X]}$	H_0: β=1 (p- value)
Gender				
Female	0.54	0.66	1.22	0.489
Male	0.46	0.35	0.75	0.500
Race				
Black	0.32	0.46	1.43	0.404
Hispanic	0.29	0.44	1.53	0.340
White	0.25	0.03	0.13	0.168
Other	0.14	0.10	0.73	0.692
Dependency status				
Dependent	0.92	0.98	1.07	0.526
Independent	0.08	0.02	0.23	0.544
Parental education				
Less than high school	0.05	0.10	1.94	0.496
High school	0.39	0.39	0.99	0.986
Some college +	0.49	0.45	0.91	0.789
Missing	0.08	0.06	0.72	0.808
Initial degree program				
AA/AS	0.40	0.34	0.85	0.703
BA/BS	0.60	0.75	1.25	0.384
Foreign born				
Parent	0.51	0.50	0.98	0.962
Student	0.18	0.16	0.91	0.892
SAT scores				
Missing	0.32	0.55	1.72	0.189
Above median math	0.20	0.18	0.91	0.884
Below median math	0.48	0.31	0.65	0.347
Above median verbal	0.19	0.05	0.24	0.268
Below median verbal	0.49	0.45	0.91	0.787

*Note*s: First-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. $E[X]$ represents the average characteristic among students near the Pell Grant eligibility threshold, estimated via a regression of that characteristic on a quadratic in $\widetilde{EFC}$ (allowed to vary on either side of the eligibility threshold). $\beta = \frac{E[X|switcher]}{E[X]}$ represents the relative likelihood that an individual with characteristic X is a switcher. We estimate this term by taking the ratio of the coefficient on $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ from a regression of any borrowing $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and a quadratic in $\widetilde{EFC}$ (allowed to vary on either side of the eligibility threshold) using the full sample to the same coefficient when the sample is limited to students who have characteristic X. $E[X|Switcher] = \beta E[X]$. The fourth column displays the $p-$ value from the test of $\beta = 1$, which is a test of whether the probability that a switcher has characteristic X significantly differs from the probability that a member of the full sample has characteristic X. Students with EFC greater than \$4,000 from Pell Grant eligibility threshold in their first year are excluded. All dollar amounts adjusted to represent constant 2012\$.

Table B.10: Heterogeneity in the Impact of Pell Grant Aid on Borrowing
by Availability of Online Loan Application

	(1) First-year students		(2) Returning students	
Online loan application?	N	Y	N	Y
Pell Grant aid	-0.417	-0.452	-0.416	-0.684
	(0.110)**	(0.166)**	(0.116)**	(0.162)**
Test of eq: *p*-value	0.859		0.179	
Crowd-out | borrower	-1.870	-1.720	-1.705	-2.158
	(0.348)**	(0.480)**	(0.410)**	(0.290)**
H_0: crowd-out > -1, *p*-value	0.006	0.067	0.043	<0.001
Test of eq: *p*-value	0.936		0.804	
Observations	38,100		46,744	

*Note*s: 2SLS estimates of the impact of an additional dollar of Pell Grant aid on borrowing for all students and for would-be borrowers. Column 1 sample includes first-year CUNY undergraduate degree-seeking students; 2007 through 2011 cohorts. Column 2 sample includes second- and third-year CUNY undergraduate degree-seeking students; 2005 through 2011 cohorts. Each column represents estimates from a separate regression. Clustered standard errors (institution by year) in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Table B.2 notes for a list of additional controls. All covariates are fully interacted with indicator for whether a student is attending a school that provides an online application for loans. Four of the 17 CUNY institutions provided an online loan application. Excluded instruments are $\mathbf{1}[\widetilde{EFC}_{it} < 0]$ and $\widetilde{EFC}_{it} \times \mathbf{1}[\widetilde{EFC}_{it} < 0]$ interacted with indicator for having the listed characteristic. Students with EFC greater than $4,000 from Pell Grant eligibility threshold are excluded. All dollar amounts adjusted to represent constant 2012$.

Appendix C: Proofs

In this appendix we demonstrate that the solution has the form described in Section 3. Proofs of the predictions in Section 3.1 follow directly.

First, the student's problem has between one and two optima. The strict concavity of $u(\cdot)$ and $w(\cdot)$ and convexity of $C(\cdot)$, along with piecewise linearity of the cost of borrowing and the regularity condition $w''(s) \leq -R_m C_t''(s)$, imply that the problem is strictly concave in both d and s where differentiable. The proof is trivial except to note that the regularity condition is sufficient because

$$\frac{\partial^2}{\partial s^2} u(c_1) = \frac{\partial^2}{\partial s^2} u\left(w(s) - R_s d - \kappa_s (R_m - R_s)\left(d - \bar{d} - \xi\left(C_t(s) - g - EFC - \bar{d}\right)\right)\right)$$

$$= \frac{\partial}{\partial s}\left(w'(s) + \kappa_s \xi (R_m - R_s) C_t'(s)\right) u'(c_1)$$

$$= \left(w''(s) + \kappa_s \xi (R_m - R_s) C_t''(s)\right) u'(c_1) + \left(w'(s) + \kappa_s \xi (R_m - R_s) C_t'(s)\right)^2 u''(c_1)$$

and

$$w''(s) \leq -R_m C_t''(s) \Rightarrow w''(s) + \kappa_s \xi (R_m - R_s) C_t''(s) \leq 0 \Rightarrow \frac{\partial^2}{\partial s^2} u(c_1) < 0$$

Therefore, the problem is concave except for the discontinuity at $d = 0$. The domain of s is bounded by assumption, which therefore places bounds on d because consumption cannot be negative. Hence, there is at least one solution. The solution will not include d at the lower bound that makes $c_0 = 0$ because $c_1 > 0 = c_0 \Rightarrow \frac{\partial u(0)}{\partial d} \geq \frac{\partial u(c_1)}{\partial d} \geq \frac{\partial \beta u(c_1)}{\partial d}$, which implies that total utility would be increased by raising d above this level. Similarly, s is bounded from above by non-negativity of c_0 and the fact that d is bounded above by $\bar{\bar{d}}$, and the upper bound for s will not be optimal. Any solution for observed students (for whom the lower bound $s = 0$ is revealed to be suboptimal) satisfies the first order condition with respect to s (1), and either the first order condition with respect to d given by equation (2), $d = 0$, or $d = \bar{\bar{d}}$ (3).

Second, the solution is unique with probability one. Because the entire problem would be concave if not for the discontinuity, and because the discontinuity reduces utility for values of d greater than zero, any solution with $d < 0$ is unique. It may be, however, that an allocation with $d > 0$ gives the same utility as one with $d = 0$. If two solutions exist for a given level of EFC we denote the positive debt amount chosen in one solution by $\underline{d}$. Because student resources are continuously distributed, $\underline{d}$ is optimal with probability zero.

Third, the solution takes the monotonically ranked form described in Section 3. The empirical size (possibly zero) of each group will depend on the parameter values and the distribution of resources among

students. Here we establish the theoretical existence of each group of students and their ranking by resources.

Consider schooling level $\bar{s}$ satisfying the equation $R_s C'(\bar{s}) = w'(\bar{s})$ and $\omega = u^{-1}(R_s\beta u(w(\bar{s}) + \epsilon)) + C(\bar{s}) - EFC - g$ for some $\epsilon > 0$. If debt is zero, this allocation gives $u(c_0) = R_s\beta u(w(\bar{s}) + \epsilon) > R_s\beta u(w(\bar{s})) = u(c_1)$. Raising s would increase total utility, but lowering d by an amount that causes the same reduction in c_0 would cause a greater rise in c_1, implying that a negative value of debt must be optimal.

Since $d^* < 0$, $\kappa_0 = \kappa_s = \lambda = 0$. (1) and (2) hold, and combining them gives $R_s C'(s^*) = w'(s^*)$. $\frac{\partial s^*}{\partial g} = 0$, while differentiation of (2) gives $\frac{\partial d^*}{\partial g} = -\frac{u''(c_0)}{u''(c_0) + R_s^2\beta u''(c_1)} \in (-1, 0)$. Note that g and ω are interchangeable in the problem, the optimal allocation responds to ω in the same way that it responds to g: Higher values of ω reduce d^* and have no effect on s^*. The conditions hold until ω becomes low enough that $d^* = 0$. We label those with resources high enough to induce negative borrowing (i.e. net saving) Group A.

At $d^* = 0$, $\frac{\partial d^*}{\partial g} = 0$ and of the first-order conditions only (2) holds. We label the mass of students with exactly zero debt as Group B. Differentiation gives

$$\frac{\partial s^*}{\partial g} = -\frac{C'(s^*) u''(c_0)}{C''(s^*) u'(c_0) - C'(s^*)^2 u''(c_0) - w''(s^*) u'(c_0) - w'(s^*)^2 u''(c_0)} > 0$$

Denote the optimal schooling choice when $d^* = 0$ as s_0^* (suppressing the arguments of this function to simplify notation). If the fixed cost of borrowing is not too large there will be additional groups with positive debt. Students in Group B obtain utility $u(\omega + EFC + g - C(s_0^*)) + \beta u(w(s_0^*))$. Students with positive debt obtain utility $u(\omega + EFC + g - C(s^*) - \gamma) + \beta u(w(s) - R_s d - \kappa_s(R_m - R_s)(d - \bar{d} - \xi(C_t(s^*) - g - EFC - \bar{d})))$. The level of debt for which the two utilities are equivalent is $\underline{d}$. If $\underline{d} < \bar{d}$ there will be a Group C for which $d \in (\underline{d}, \bar{d})$ and both (1) and (2) hold. As with Group A, $R_s C'(s^*) = w'(s^*)$, $\frac{\partial s^*}{\partial g} = 0$, and $\frac{\partial d^*}{\partial g} = -\frac{u''(c_0)}{u''(c_0) + R_s^2\beta u''(c_1)} \in (-1, 0)$. The optimal $d*$ is strictly decreasing with ω except in the region for which small positive amounts of debt are dominated by zero debt as a result of the fixed cost of borrowing.

As resources continue to fall, d^* may rise to the level of d_s^{max}. For Group D, $d^* = d_s^{max} = \bar{d} + \xi(C_t(s^*) - g - EFC - \bar{d}) \Rightarrow \frac{\partial d^*}{\partial g} = \xi\left(C_t'(s^*)\frac{\partial s^*}{\partial g} - 1\right)$, and because (2) holds, $\frac{\partial s^*}{\partial g} > 0$ as was the case for Group B. The conditions and properties of Groups E and F follow those of Groups A and B, respectively.

Derivation of the listed implications follows. Denote ω_X as the highest value of in each Group X and $F(\omega)$ the cumulative distribution function for ω, conditional on g and EFC. The monotonicity of the policy implies that Group F has mass $F(\omega_F)$, Group E has mass $F(\omega_E) - F(\omega_F)$, Group D has mass $F(\omega_D) - F(\omega_E)$, etc. Because the policy function is discontinuous, implications are shown for a discrete change ϵ in the amount of grant aid received.

1. If the fixed cost $\gamma > 0$ then $\underline{d} > 0$ and an increase in grant aid may lead to a greater than \$1 for \$1

reduction in loans for borrowers.

Consider a number $\delta \in (0, \gamma)$ and let $s^*(\gamma - \delta)$ denote optimal schooling when $d^* = \gamma - \delta$. The choice of $d = 0$ and $s = s^*(\gamma - \delta)$ gives strictly greater utility than $d = \gamma - \delta$ and $s = s^*(\gamma - \delta)$. This implies a strictly dominated range of debt values between zero and some $\underline{d} > \gamma > 0$. Now suppose *all* students have $\omega = \omega_C$ and $d = \underline{d}$. An increase in grant aid from g to $g + \delta/2$ induces these students to stop borrowing. Crowd-out is $\frac{\triangle d}{\triangle g} = \frac{\delta}{\delta/2} = 2 > 1$.

2. Grants only increase schooling for students facing some form of borrowing constraint.

This implication follows directly from the schooling policy functions.

3. Grants decrease educational attainment of students whose optimal debt level drops from (weakly) above $\underline{d}$ to a positive amount below $\underline{d}$.

Regardless of the choice of d, the choice of s satisfies (2):

$$C'(s)\, u'(\omega + EFC + g + d - C(s) - \gamma \cdot \kappa_0)$$

$$= \beta \left(w'(s) - \xi \kappa_s (R_m - R_s) C_t'(s)\right) u'\left(w(s) - R_s d - \kappa_s (R_m - R_s)\left(d - \bar{d} - \xi\left(C_t(s) - g - EFC - \bar{d}\right)\right)\right)$$

Label as $\underline{s}$ the value of s that satisfies this equation when $d = \underline{d}$. As shown above, the choice of $d = 0$ dominates $d \in (0, \underline{d})$. An increase in grants that induces switching from $d = \underline{d}$ to $d = 0$ decreases the value of the left-hand side of the equation (because of the increase in grants and the fact that $\underline{d} \geq \gamma$) and increases the value of the right-hand side. The necessary adjustment to s is downwards because (assuming $d < d_s^{max}$ to simplify notation):

$$\frac{\partial}{\partial s} \left[C'(s)\, u'(\omega + EFC + g - C(s)) - \beta\left(w'(s)\right) u'(w(s) - R_s d)\right]$$

$$= C''(s)\, u'(c_0) - C'(s)^2 u''(c_0) - \beta w''(s)\, u'(c_1) - \beta w'(s)^2 u''(c_1)$$

$$> 0$$

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