

Online Appendix for: “Matching Pell Grants: Implications for College Debt and Parental Transfers”

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January 16, 2023

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1 Model Derivation

This section presents the derivation of the equilibrium of the model introduced in Section II of the paper.

1.1 Student problem

To solve the student's problem solve for h as a function of b in equation (1) in the paper:

$$h = 1 - (\tau - x - b)$$

and replace this equation into the student's objective function:

$$\max_b f(1 - (\tau - x - b)) - R(b).$$

The first-order condition with respect to b is

$$f'(1 - (\tau - x - b)) = R'(b). \tag{1}$$

This pins down $b(x)$ as a function of x . Using the quadratic functional forms we obtain the following version of (1):

$$a - (1 - (\tau - x - b))/\delta = 1 + r + \eta b, \tag{2}$$

which can be solved for

$$b(x) = \frac{\delta(a - (1 + r)) - 1}{\eta\delta + 1} + \frac{\tau - x}{\eta\delta + 1}. \tag{3}$$

Human capital investment is

$$h(x) = 1 - (\tau - x - b(x)). \tag{4}$$

The implied consumption of the student is then

$$c_s(x) = f(1 - (\tau - x - b(x))) - R(b(x)). \tag{5}$$

1.2 Parent Problem

The parent solves

$$\max_x y - x - 0.5(y - x)^2 + \gamma c_s(x).$$

The first-order condition is

$$-1 + (y - x) + \gamma c'_s(x) = 0, \quad (6)$$

where by envelope theorem applied to (5):

$$c'_s(x) = f'(1 - (\tau - x - b(x))) = 1 + r + \eta b(x), \quad (7)$$

where the second equality sign follows from (2). Replacing (7) into (6) yields

$$b(x) = \frac{1 - y - \gamma(1 + r)}{\gamma\eta} + \frac{x}{\gamma\eta}. \quad (8)$$

1.3 Equilibrium

Replace $b(x)$ from (3) into (8) and solve for the equilibrium value of x :

$$x^*(\tau) = \bar{x} + \gamma\eta\pi_b\tau,$$

where

$$\pi_b = (1 + \delta\eta + \gamma\eta)^{-1},$$

and

$$\bar{x} = \pi_b (\delta\gamma\eta (a - (1 + r)) + (y - 1 + \gamma(1 + r)) (\delta\eta + 1)).$$

The implied debt is

$$\begin{aligned} b^*(\tau) &= b(x^*(\tau)) = \frac{1 - y - \gamma(1 + r)}{\gamma\eta} + \frac{\bar{x} + \gamma\eta\pi_b\tau}{\gamma\eta} \\ &= \bar{b} + \pi_b\tau \end{aligned}$$

where

$$\bar{b} = \frac{1 - y - \gamma(1 + r) + \bar{x}}{\gamma\eta}.$$

Finally, the human capital input is

$$\begin{aligned} h^*(\tau) &= 1 - \tau + x^*(\tau) + b^*(\tau) \\ &= 1 - \tau + \bar{x} + \gamma\eta\pi_b\tau + \bar{b} + \pi_b\tau \\ &= \bar{h} - (1 - (1 + \gamma\eta)\pi_b)\tau \\ &= \bar{h} - \delta\eta\pi_b\tau, \end{aligned}$$

where

$$\bar{h} \equiv 1 + \bar{x} + \bar{b}.$$

2 IPEDS Comparison

In this section we briefly compare LPU with public and private 4 year institutions. The data used for this comparison is from the Integrated Postsecondary Education Data System (IPEDS) and is presented in Table 1. Notice that, while the IPEDS data are computed from the entire student body at LPU, in the paper we specialize our analysis to various sub-samples. For example, Table 1 in the paper refers to Pell grant recipients only. Table 2 in the paper refers to students who completed a FASFA form and who are either Pell grant recipients or whose parental income is smaller than \$91,000.

According to the IPEDS data, the average net price for students awarded grant or scholarship aid in 2016-17 was \$22,848 for the flagship campus and \$18,345 for the regional campuses.¹ These figures make the net price at the flagship campus in the top 1% among public four-year institutions and approximately average among private not-for-profit four-year institutions. The regional campuses' average net price places them in the top 10% among public institutions and make them more expensive than about 30 percent of private not-for-profit four-year institutions. Perhaps as a result of this fact, according to IPEDS, the percentage of all undergraduates receiving Federal student loans at the flagship campus in AY 2016-17 was 51 percent, which is equal to the mean of private not-for-profit four-year institutions.² LPU's flagship campus also compares favorably to a private not-for-profit four-year institution in terms of its admission rate (55% vs 59%) and average SAT scores (1,286 vs 1,132) while its regional campuses with an average admission rate of 69% and SAT score of 1,010 resemble more an average four-year public institution with corresponding statistics 66% and 1,090. Finally, notice that the enrollment figures for LPU's regional campuses reported by IPEDS are about one third of those we are aware of based on administrative data.

¹According to the IPEDS, the "Average net price is generated by subtracting the average amount of federal, state or local government, or institutional grant and scholarship aid from the total cost of attendance".

²For reference, the fraction of all undergraduate students with Federal student loans at public four-year institutions is 41 percent. In LPU's regional campuses, about 72 percent of undergraduates have Federal student loans. This reflects the fact that average household income is significantly smaller for students attending LPU's regional campuses.

	(1)	(2)	(3)	(4)
	Flagship	LPU Regional Campuses	Public	4-year Private
Undergraduate enrollment	19,123	2,107	19,373	9,427
Admission rate	55	69	66	59
% white	73	78	53	55
% female	52	49	54	57
% minority	13	13	32	27
% out of state	38	14	16	n.a.
SAT score reading and math	643	505	545	566
Six-year graduation rate	79	52	54	60
Retention rate (full-time)	92	75	80	79
Average net price aid>0	22.8	18.3	13.2	25.4
Average total aid aid>0	11.3	8.6	7.4	17.7
% of UG receiving aid	54	77	60	74
Average Pell grant aid Pell aid>0	4.1	4.1	4.2	4.2
% of UG receiving Pell grants	16	35	34	32
Average federal loans loans>0	6.8	6.6	6.5	7.0
% of UG receiving federal loans	51	72	41	51
Observations	1	3	728	1,345

Table 1: Descriptive statistics for LPU and other 4-year institutions in 2016-17. Source: Integrated Postsecondary Education Data System. Dollar amounts are expressed in thousands of dollars. The data refer to the entire population of undergraduate students at LPU.

3 Survey

In this section we report the results of a survey of undergraduate students enrolled at LPU in academic year 2019-20 that we conducted in the Summer of 2019. The survey was conducted to learn more about the sources of funding for students and their time allocation, during the summer of 2019. The survey response rates were about 23% for sample of students we use in the paper (students who are either Pell grant recipients or whose parental income is smaller than \$91,000). We find that recipient of Pell grants were 3 percentage points more likely to answer the survey than non-recipients. The survey asked students a number of retrospective questions pertaining to the academic year 2018-19. A set of questions refers to the sources of college financing for students: family transfers, own savings, income earned, grant aid, and loans. Results are summarized in Table 2. The Table reports the percentage contributions of family transfers, own savings, earnings, grants and loans to funding the COA for Pell and non-Pell recipients.

A second set of questions refers to the students' time allocation during the academic year and during the summer months. Table 3 reports some detail about the allocation of time of Pell and non-Pell recipients, based on our survey data. During the academic year, Pell recipients report working about 2 hours per week more than non-Pell students. This gap is partially offset by 1 hour per week less spent studying by Pell students relative to non-Pell. The gaps in the regional campuses are qualitatively similar but quantitatively smaller. Labor supply in the summer is relatively larger for non-Pell students who are also more likely to have (paid) internships.

	(1)	(2)	(3)
	No Pell	Pell	p-value
% family	22	14	0.00
% savings	10	9	0.27
% earnings	6	7	0.37
% grants	23	35	0.00
% loans	39	35	0.01
Observations	505	790	1,295

Table 2: How students pay for the COA at LPU. Data source: survey of LPU's undergraduate population conducted in Summer 2019. The responses we report correspond to the sample of Pell students and non-Pell students with parental income lower than \$91,000.

	(1)	(2)	(3)
	No Pell	Pell	p-value
Academic year			
% work	15	17	0.05
% study	35	34	0.02
% lecture	36	36	0.41
% extra-curricular	13	13	0.36
Summer 2018			
% internship	16	13	0.17
% paid internship	12	10	0.23
Weekly average hours worked	26	24	0.09
Observations	506	790	1,296

Table 3: Time allocation by students at LPU. Data source: survey of LPU's undergraduate population conducted in Summer 2019. The responses we report correspond to the sample of Pell students and non-Pell students with parental income lower than \$91,000.

	(1)	(2)	(3)	(4)	(5)	(6)
	Flagship Campus No Pell	Flagship Campus Pell	p-value	Regional Campuses No Pell	Regional Campuses Pell	p-value
% male	43	43	0.99	49	44	0.00
% white	81	69	0.00	89	75	0.00
SAT/ACT	1,334	1,310	0.00	1,101	1,073	0.00
At least one parent w/ college degree	81	69	0.00	66	56	0.00
Parental income (\$1,000)	69	31	0.00	70	31	0.00
Family cash savings (\$1,000)	18	4	0.00	9	2	0.00
Observations	4,087	4,896	8,983	2,453	3,898	6,351

Table 4: Demographic information of LPU students by Pell status and campus. Source: administrative data, 2016-2019. Sample of returning students with parental income lower than \$91,000.

4 Demographics

Table 4 presents some descriptive statistics for the regression sample of Pell and non-Pell students we use in the paper. By definition, Pell grant recipients come from families with significantly lower income and liquid wealth than non-Pell students with parental income smaller than \$91,000. They are also less likely to be white and to have parents with a college degree.

5 Financing the Cost of Attendance

Tables 5 and 6 present more detailed information on financing the COA by students in the regression sample used in the paper (returning students with parental income lower than \$91,000 and Pell students), breaking down the data by Pell status and campuses, before and after the implementation of the PM program. These tables are expanded version of Table 2 in the paper.

Attending LPU requires students to finance a cost of attendance (COA). The latter covers tuition, room and board, a book allowance, miscellaneous expenditures such as clothes and travel, and a variety of fees. Thus, the COA already includes consumption expenditures while in college as related to lodging and food for example. The COA is the same for all students with a certain profile. For example, it is the same for all first-year students who are residents of the state in which LPU is located, and who enroll in a given school (e.g. Arts and Sciences, Engineering, etc.). Depending on their specific circumstances, students may not have to pay the COA, but rather a discounted amount, thanks to a number of grants, fellowships, and scholarships funded by LPU (institutional aid), the local, state,

and federal governments, and/or private organizations. Pell grants are one of the main federally funded grants targeting students from low-income households. Subtracting grants, whose common feature is that they do not need to be re-paid (they are not loans), the student is left with what we label RCOA, or "remaining cost of attendance." Notice that LPU represents the major source of grants for non-Pell students, while before 2019 state and federal grants (such as Pell grants) accounted for about 50 percent of grants received by Pell recipients at LPU's flagship campus. Pell recipients still have to finance more than 60 percent of their COA after grants are taken into account. In order to fund the RCOA, the student might take some loans, work, or obtain resources from family and friends. Loans are offered by the Federal government or private institutions. Federal loans, in turn, can be either "subsidized" - the Federal government makes interest payments while the student is enrolled - or "unsubsidized", in which case interest payments have to be covered by students from the moment the loan is issued. Federal loans of each type are capped annually and over the student's lifetime. Private loans are issued by private entities and often require a guarantor's signature or some form of collateral. In our analysis we consider "loans" only loans to students, while we view loans to parents - such as Parent Plus loans - as parental transfers. Prior to 2019 the average Pell grant student at the flagship campus borrowed about 7.8 thousand dollars per year versus 8.9 for non-Pell students. Pell students rely relatively more on Federal loans than private ones. Students may work while studying in order to cover their RCOA. While in general we do not observe a student's labor supply, we know whether they receive a Federal Work Study award and for which amount. These awards are funded by the Department of Education and made to students with demonstrated financial need. The latter work on campus for a maximum of 20 hours a week. In our sample, Pell recipients earn on average about one thousand dollars through the Federal Work Study program, about three times as much as non-Pell students. After subtracting student loans and work study income, at the flagship campus non-Pell recipient still have to finance about 62 percent of the COA, while before 2019 Pell recipients are left with about 47 percent of their COA to fund. These figures are smaller, but still substantial, for students enrolled in the regional campuses. Students fund this remaining amount through a mix of parental transfers, pre-college savings, and labor supply that we cannot measure directly. While parents can transfer resources to their children in a variety of ways, such as drawing down existing assets for example, an available measure of transfers are Parent Plus Loans, which are federal loans for which parents are directly responsible. Before 2019 these amounted to about \$2,000 to \$3,000 per year.

	(1)	(2)	(3)	(4)
	2016-2018	2019	2016-2018	2019
	No Pell	No Pell	Pell	Pell
Cost of attendance	37.0	37.9	36.9	36.9
Total grants	7.6	7.8	13.6	18.1
Institutional grants	5.4	6.2	5.7	10.5
State grants	1.3	0.9	2.3	2.2
Federal grants	0.0	0.0	4.5	4.5
Pell grant	0.0	0.0	4.3	4.3
Private grants	1.0	0.7	1.1	0.9
Residual COA (RCOA)	29.4	30.1	23.2	18.8
Federal + private student loans	9.5	9.4	8.1	6.7
Federal loans	5.4	5.0	5.7	4.7
Private loans	4.1	4.4	2.3	2.0
Federal work study amount accepted	0.7	0.8	0.9	1.2
Out-of-pocket expenses left after loans and work study	19.2	19.8	14.2	11.0
Parent plus loans	3.1	2.7	2.9	2.0
Observations	3,166	921	3,749	1,147

Table 5: Details on cost of attendance (COA), remaining cost of attendance (RCOA), aid, and loans for flagship campus students. Source: LPU's data (sample with FASFA form). Dollar amounts are expressed as thousands of dollars.

	(1)	(2)	(3)	(4)
	2016-2018	2019	2016-2018	2019
	No Pell	No Pell	Pell	Pell
Cost of attendance	28.8	28.1	29.1	28.9
Total grants	5.9	6.1	11.7	15.8
Institutional grants	4.0	4.4	3.5	7.9
State grants	1.5	1.3	2.9	2.8
Federal grants	0.0	0.0	4.6	4.6
Pell grant	0.0	0.0	4.4	4.4
Private grants	0.4	0.3	0.7	0.6
Residual COA (RCOA)	22.9	22.0	17.4	13.1
Federal + private student loans	9.3	9.7	7.5	6.0
Federal loans	5.6	5.3	6.1	4.9
Private loans	3.7	4.3	1.4	1.0
Federal work study amount accepted	0.6	0.7	0.8	1.0
Out-of-pocket expenses left after loans and work study	13.0	11.6	9.2	6.2
Parent plus loans	2.7	2.3	1.9	1.1
Observations	1,869	584	3,010	888

Table 6: Details on cost of attendance (COA), remaining cost of attendance (RCOA), aid, and loans for regional campus students. Source: LPU's data. Dollar amounts are expressed as thousands of dollars.

6 University Program: Matching Pell Grants

Beginning in the 2019-2020 academic year, LPU instituted a major restructuring of its financial aid program. This was announced on February 22, 2019, and went into effect with the Fall semester of 2019. The restructuring had two major components. The first component was a match of federal Pell grants: each Pell-eligible student would receive extra institutional aid equal to the amount awarded to them by the federal government. We refer to this component as the Pell match program, or PM.³ The second component capped a student's unmet need to \$20,000 by means of targeted institutional aid. Differently from the PM program, the second component was only offered to first time incoming freshmen. In our regression analysis we focus exclusively on the PM program.⁴ Figure 1 illustrates the change in RCOA for Pell and non-Pell students between 2018-19 and 2019-20.

7 Ordinary Least Squares Estimates

Table 7 contains the ordinary least squares estimates of equation (6) in the paper.

	(1)	(2)	(3)	(4)
	Federal loans	Private loans	Parent plus loans	Federal work study earnings
RCOA	0.087*** (0.006)	0.199*** (0.011)	0.218*** (0.011)	0.006* (0.003)
Observations	11,223	11,223	11,223	11,223
R ²	0.829	0.865	0.863	0.711

Table 7: Ordinary least squares estimates of equation (6) in the paper. See the paper for a description of the control variables.

8 Credit Hours, Semester GPA and Fall Retention

Table 8 contains the results of estimating equation (6) with credit hours, semester GPA, and fall retention as dependent variables.

³Among enrolled students who have accepted the aid, LPU has paid \$12.2 millions for the PM program.

⁴Technically, while we include freshmen in our regression sample, they do not contribute to identify the impact of the PM program because we introduce student fixed effects in all the regression equations. In Section ?? of this Appendix we present regression results excluding freshmen from the sample and show that they are basically the same as in Table 3 in the paper.

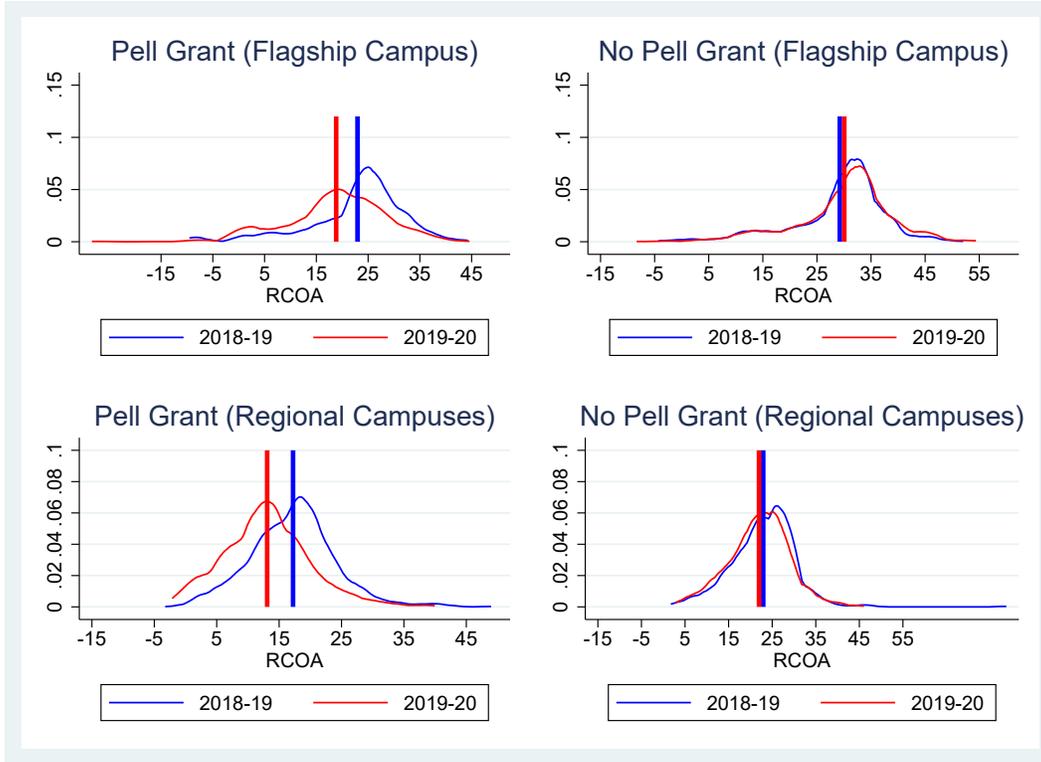


Figure 1: Kernel estimates of densities of RCOA between 2018-19 and 2019-20 for Pell and non-Pell recipients in our regression sample (flagship and regional campuses).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	Credit hours IV	IV	OLS	Semester GPA IV	IV	OLS	Fall retention IV	IV
RCOA	0.031*** (0.010)	-0.011 (0.042)	-0.002 (0.048)	-0.010*** (0.001)	0.010* (0.006)	0.016** (0.007)	-0.091*** (0.030)	-0.112 (0.112)	-0.153 (0.133)
RCOA x high borrower			-0.019 (0.044)			-0.013** (0.007)			0.103 (0.115)
Observations	11,223	11,223	11,223	11,223	11,223	11,223	11,015	11,015	11,015
R2	0.560	0.039	0.039	0.768	0.020	0.004	0.500	0.087	0.086
K-P F-statistic		322.289	120.025		322.289	120.025		327.380	116.808

Table 8: This table presents regression results considering as dependent variables credit hours, semester GPA, and fall retention. The specification of the regression is the same as described in the paper.

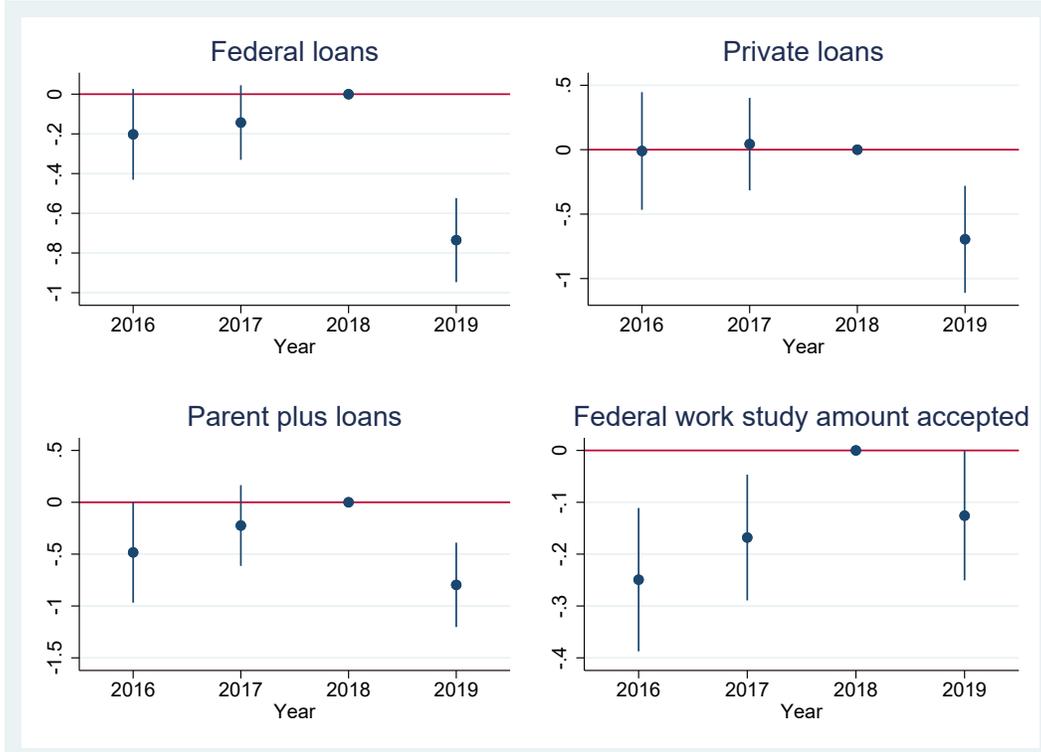


Figure 2: Pre-trend analysis

9 Pre-Trend Analysis

Figure 2 presents the results of the pre-trends analysis for the dependent variables we consider in the paper.

10 Admission Analysis

We tested whether the PM program increased enrollment of admitted Pell students at LPU. Given the timing of the announcement of the PM program (February 2019) we don't expect it to have had a major influence on applications for that academic year (2019-20). The regression equation we estimated takes the form

$$enroll_{it} = Pell_i + \gamma_t + Pell_i \times admission2019_t + \beta X_{it} + \varepsilon_{it}, \quad (9)$$

	(1)	(2)	(3)	(4)	(5)	(6)
	DiD	DiD	DiD	Event study	Event study	Event study
	All	Flagship	Regional Campuses	All	Flagship	Regional Campuses
Pell \times 2019	-0.003 (0.012)	0.007 (0.018)	-0.011 (0.015)	0.000 (0.014)	0.003 (0.022)	-0.001 (0.018)
Observations	27,355	12,433	14,922	27,355	12,433	14,922
R ²	0.095	0.081	0.098	0.095	0.082	0.098

Table 9: PM program impact on enrollment of Pell students (dependent variable). “DiD” refers to estimating equation (9). “Event study” refers to a version of the regression with year-by-Pell status interactions for 2017 and 2016 in addition to 2019. All regressions also control for parental income, parental income squared, family cash savings, SAT scores, father and mother education level, dummies for: academic school of enrollment, campus-by-year, ethnic/racial background, male, in-state status, admission year (2016-2019), Pell grant status.

where the dependent variable $enroll_{it}$ is a dummy for enrollment, $Pell_i$ is a dummy for being a Pell recipient, γ_t is a time dummy, $admission2019_t$ denotes the admission season for academic year 2019-20, and X_{it} is a vector of demographic controls. We also estimated a version of this equation with interactions of $Pell_i$ with admissions for academic years 2017-18 and 2016-17 (labelled “event study”). The sample consists of Pell students and those whose parental income is less than \$91,000. This is the same sample used in the paper. Results are summarized in Table 9. Notice that there is no evidence that the PM program increased Pell students’ freshmen enrollment at LPU.

11 Comparison with the Literature

In Section 4 of the paper, we compare some of our results with those in the literature. In this section we provide more detail on this comparison.

1. Denning, Marx and Turner (2019). Their Table 2 present results for some of the same variables we consider. According to their estimates, a first-time-in-college (FTIC) student who qualifies for automatic zero EFC receives on average an additional \$653 in total grant aid (column 2). Student loans fall by \$343 (column 8), for an implied impact of 52 cents on the dollar of aid on debt reduction. According to their Table 3, credit hours increase by 0.256 for FTIC students who are automatically eligible for a zero EFC. The corresponding structural impact of grant aid on credits is therefore 0.39 additional credit hours per \$1,000 in additional aid (for simplicity we use 0.4 in the paper). They also estimate directly the effect of automatic zero EFC on students’ earnings while in college (column 7), which is -\$134 and -\$88 for FTIC and returning

students, respectively (but these results are not statistically significant). The earnings results for FTIC correspond to an implied response of earnings of about 20 cents on the dollar, which is somewhat smaller than the 34 cents on the dollar estimated using the reaction of credits.

2. Marx and Turner (2018). Their Table 5, Panel B, presents 2SLS estimates of Pell grant aid on borrowing, showing a decline of 43 cents on the dollar for first-year students and 51 cents on the dollar for returning students. Results on credit attempted and earned are presented in their Table 8, panels B and C. The effect on credits attempted is close to 0.5 (although not statistically significant), which is close to the one estimated by Denning, Marx and Turner (2019).
3. Abbott et al. (2019). The results from this paper that are cited in the paper are drawn from Section V.5.C of this paper and the Online Appendix, Section J, Table J.15. In particular, the offset of 82 cents on the dollar cited in the paper is computed as the P.E. (partial equilibrium) short-run change in intervivos transfers $(-3,298)$ for the first income group ($q = 1$) divided by 4,000 which is the cumulative expansion of the grant.

12 Data Availability Statement

This section concerns the replication of the results of the paper. It contains the same information as the README.TXT file you will find in the data repository. The original data files were made available to the paper's authors by LPU. The data cannot be posted or shared. To gain access to the data you will need to ask for authorization of use to LPU directly (contact Daniele Coen-Pirani, coen@pitt.edu about it).

The original LPU data files have the following names:

Fall 2005 Attending Inst Data.xlsx Fall 2018 Attending Inst Data.xlsx
FFR Data from Dashboard.xlsx
Fall 2005 - 19 Fsh COA.xlsx
First Home Address.xlsx
Fall 2005 - 19 Upit Fsh Data.xlsx
Fall 2005 - 19 Upb Fsh Data.xlsx
Fall 2005 - 19 Upj Fsh Data.xlsx
Fall 2005 - 19 Upt Fsh Data.xlsx
Fall 2005 Fsh Fin Aid.xlsx Fall 2019 Fsh Fin Aid.xlsx.

The file CPIAdjustment.xlsx contains the Consumer Price Index (it is contained in the folder \data\raw\).

After having obtained access to the data, to replicate the results in the paper and the appendix you will need to run the following Stata do files in this order:

1. `\data\do\DataCleaningV1.do`: it generates the dataset `FinalDataWide.dta` from the original LPU data files.
2. `\data\do\setup_master.do`: it loads `FinalDataWide.dta` and generates all the results in the paper and in the appendix.

The data dictionary for the variables obtained from LPU is contained in the file `data\data_dictionary\DATA DICTIONARY` (word file).

Other material useful for replication:

1. The data file `\data\raw\IPED_sample_2016.dta` is needed to generate Appendix Table 1.
2. The data file `\data\raw\CPIAdjustment.dta` contains the CPI index.
3. The PDF files in the directory `\data\official_sources\NCES-NPSAS` contain the statistics from the National Post-secondary student aid study of 2016 reported in Table 1 of the paper (they refer to Pell students).

References

- Abbott, Brant, Giovanni Gallipoli, Costas Meghir, and Giovanni L. Violante.** 2019. “Education Policy and Intergenerational Transfers in Equilibrium.” *Journal of Political Economy*, 127(6).
- Denning, Jeffrey, Benjamin M. Marx, and Lesley J. Turner.** 2019. “ProPelled: The effects of grants on graduation, earnings, and welfare.” *American Economic Journal: Applied Economics*, 11(3): 193–224.
- Marx, Benjamin, and Lesley Turner.** 2018. “Borrowing Trouble? Human Capital Investment with Opt-In Costs and Implications for the Effectiveness of Grant Aid.” *American Economic Journal: Applied Economics*, 10(2): 163–201.