Grants vs. Loans: the Role of Financial Aid in College Major Choice

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Introduction

- Choice of college major is an important investment decision
  - Comparable to decision of whether to attend university at all
  - Return heterog. across majors $\geq$ college premium (Patnaik et al., 2020, Kirkeboen et al., 2016)
- Two margins why student loan recipients might differ from grant holders:
  1. Concerns about repayment $\Longrightarrow$ choice of high return field
  2. Uncertainty about graduation $\Longrightarrow$ choice of "easy" field

Preview of Talk and Findings

- We use quasi-random allocation of loans and grants in Chile
  - Test score threshold grants access: RD design
  - Estimate causal effect of being eligible for a grant as opposed to a loan
  - Combine the RDD with a discrete choice model to highlight mechanisms

- Being eligible for a grant as opposed to a loan:
  - Increases enrollment in higher education (mostly universities)
  - Increases STEM enrollment and graduation by up to 12.5%
  - Decreases worries about program-specific dropout probabilities and time to completion, but does not affect valuation of labor-market outcomes

Related Papers and Contribution

- Few papers on aid provision and college major choices List
  - Mainly focus on merit aid and sets of US universities
  - Lower STEM enrollment in response to more generous aid
  - Hampole (2022): $\Uparrow$ Aid $\Longrightarrow$ Low initial earnings, but steeper trajectory

- Key differences / contributions:
  1. Harmonized financial aid system across entire country
  2. Average students, not high-achievers
  3. Disentangling influence of several correlated program characteristics

Setting: Chilean Higher Education System

- As in most of Europe: students enroll in institution $\times$ major combination
- High tuition fees relative to median family income compared to rest of OECD
  - Median yearly tuition (family income): \$3,000 (\$5,600)
  - 10th percentile tuition: \$1,800
- State-backed financing of up to 90% of reference tuition (loan or grant)
- Access to financing determined as combination of:
  (i) Family income (quintile bins)
  (ii) Standardized Test taken after high school (*PSU*)

Details

Data and Empirical Strategy

- Merge Information from two data sources:
  - Ministry of Educ.: adm. records on universe of students (2011 - 2014)
  - DEMRE: PSU results and socio-dem. info for all test takers

- Our estimand of interest is the standard Sharp RD parameter:

$$\tau_{SRD} = \lim_{z \to 0^+} \mathbb{E}[Y_i | PSU_i^* = z] - \lim_{z \to 0^-} \mathbb{E}[Y_i | PSU_i^* = z]$$

- In practice, we estimate weighted local linear regressions:

$$\begin{aligned} Y_i = \beta_0 &+ \beta_1 \mathbb{1}\{PSU_i^* \geq 0\} \\ &+ \beta_2 \mathbb{1}\{PSU_i^* \geq 0\} \times PSU_i^* + \beta_3 PSU_i^* + X_i' \delta + \varepsilon_i \end{aligned}$$

Grant Take-Up | McCrary Test | Balance Test

Effect of Being Eligible for Grants (Sharp RDD)

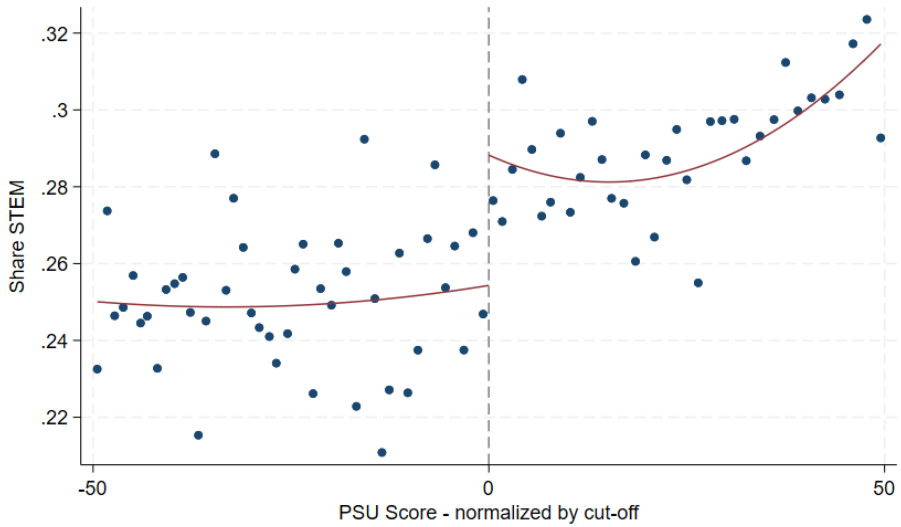
Table: Optimal Bandwidth

	STEM (=1)	Engineering (=1)	Sciences (=1)
	(1)	(2)	(3)
RD Estimate	0.029***	0.023***	0.005**
	(0.007)	(0.007)	(0.002)
Baseline Mean	0.253	0.232	0.021
Bandwidth	41	44	46
Effective N	52,522	56,358	58,733

By Year - Quintile
By Institution type
By Sociodemographics

Placebo Test
Different bandwidths

Figure: Non-parametric Evidence

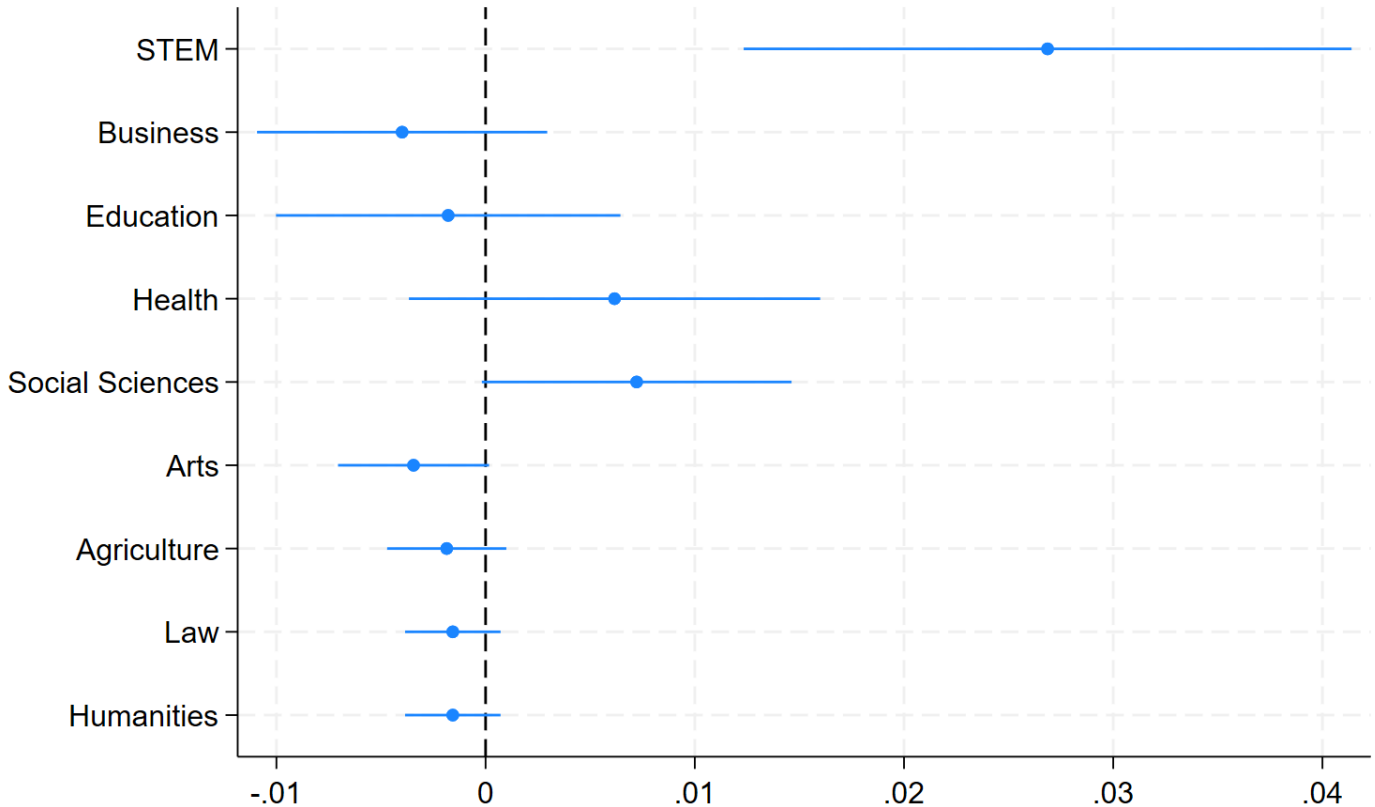


General Enrollment

Effect of Grant Eligibility on All Fields

Rescaled

Figure: Effect of Grants vs. Loans: all Fields



- Hastings et al. (2013) estimate STEM, Social Sciences, and Health to be highest-return fields in Chile

Summary and Reason for a Model

- On average, grants increase enrollment in high return fields
  - But: STEM fields also those with highest dropout rates
  - Which characteristic interacts with aid is not clear from RDD
- Model allows us to consider narrower fields (up to data limitations)
  - Ideal: compare fields with comparable characteristics, expect for one dimension
  - I.e., consider variation within STEM degrees

Data from MiFuturo.cl

Website

- Mifuturo: transparency initiative of Chilean Ministry of Education
  - Provides information on programs, drawn from past cohorts
  - We use 206 programs defined as major by institution type (university, vocational)
  - Information on: earnings for graduates in first five years, employment rates after graduation, earnings percentiles, dropout rates, formal and realized time to graduation
- No subjective expectations data, but reasonable anchor

Discrete Choice Model and Estimation

- Consider $j = 1, ..., J$ programs, with $k = 1, 2, ..., K$ characteristics, and two groups $g = \{Loan, Grant\}$
  - Example for j: Chemistry at a University
  - Example for k: Expected Earnings for graduates of j

- Students maximize over j:

$$U_{ij}^{g} = \sum_{k} x_{j,k}(\tau_k^g + \beta_k^g PSU_i^*) + \varepsilon_{ij}$$

  - PSU_i^* is individual i's test score, normalized by grant cut-off
  - $\varepsilon_{i,j}$ is i.i.d. Extreme Value Taste Shock

- Estimate $\{\tau_k^g, \beta_k^g\}_{g,k}$ by maximum-likelihood within a narrow bandwidth

$\Longrightarrow$ Our target is $\Delta_k = \tau_k^{Grant} - \tau_k^{Loan}$

Difference in Valuation of Characteristics across Aid Types

Table: Difference in Valuation of Characteristics across Aid Types: Δ_k

	(1)	(2)	(3)
Excess Study Time	0.05	0.055*	0.054**
	(0.035)	(0.03)	(0.027)
Share Dropout	1.83**	1.269*	0.907
	(0.824)	(0.714)	(0.638)
Earnings, year 1	-0.035	-0.023	-0.018
	(0.033)	(0.028)	(0.024)
Earnings Growth, year 1 to 5	0.364	0.407	0.339
	(0.358)	(0.309)	(0.276)
Earnings Pct.90/Pct.10	-0.047	-0.036	-0.023
	(0.081)	(0.070)	(0.062)
Share Employed	-0.014	-0.619	-0.767
	(2.000)	(1.715)	(1.525)
N	15,114	20,298	25,293
Bandwidth	15	20	25

- This **does not** translate into higher realized dropout rates and time spent at college Graduation results

Discussion

- Type of Financial Aid affects Students' Major Choices
  - Suggest uncertainty about degree completion as channel
- We estimate local treatment effects around PSU cut-off
  - Considered students are of average academic preparedness (contrast to e.g., Sjoquist and Winters, 2015)
- Chilean aid system is highly transparent; students are well informed
  - Previous research: uncertainty about aid eligibility impacts effectiveness (Bettinger et al., 2012; Dynarski et al., 2021)

Thank you

References

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Prueba de Selección Universitaria (PSU)

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- Administered yearly in early December by *DEMRE* (part of UChile) in country-wide testing centers
- Nationally standardized multiple choice test:
  - Two mandatory components: *Mathematics* and *Language*
  - At least one of: *Science* or *History, Geography, and Social Science*
  - Results are standardized ($\mu = 500$, $\sigma = 110$, Range: 150–850)
- Only average of mandatory fields used for grant eligibility

Eligibility Criteria for Grants

why excluding 500?

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Table: PSU Threshold for Grant Eligibility

Bicentennial and Juan Gomez Millas (JGM)				
	2012	*2013*	*2014*	*2015*
Quintile 1	550	500	500	500
Quintile 2	550	525	525	500
Quintile 3	550	550	550	500
$>$ *Quintile 3*	N.E.	N.E.	N.E.	N.E. / 500

Note: Displayed are the minimum test score averages of math and language that grant eligibility to either of the two scholarships, by year and family income quintile. N.E.: not eligible. Bicentennial and JGM grants are received conditional on enrolling in CRUCH and accredited universities, respectively.

First Stage: Take-Up of Grants around Cut-off

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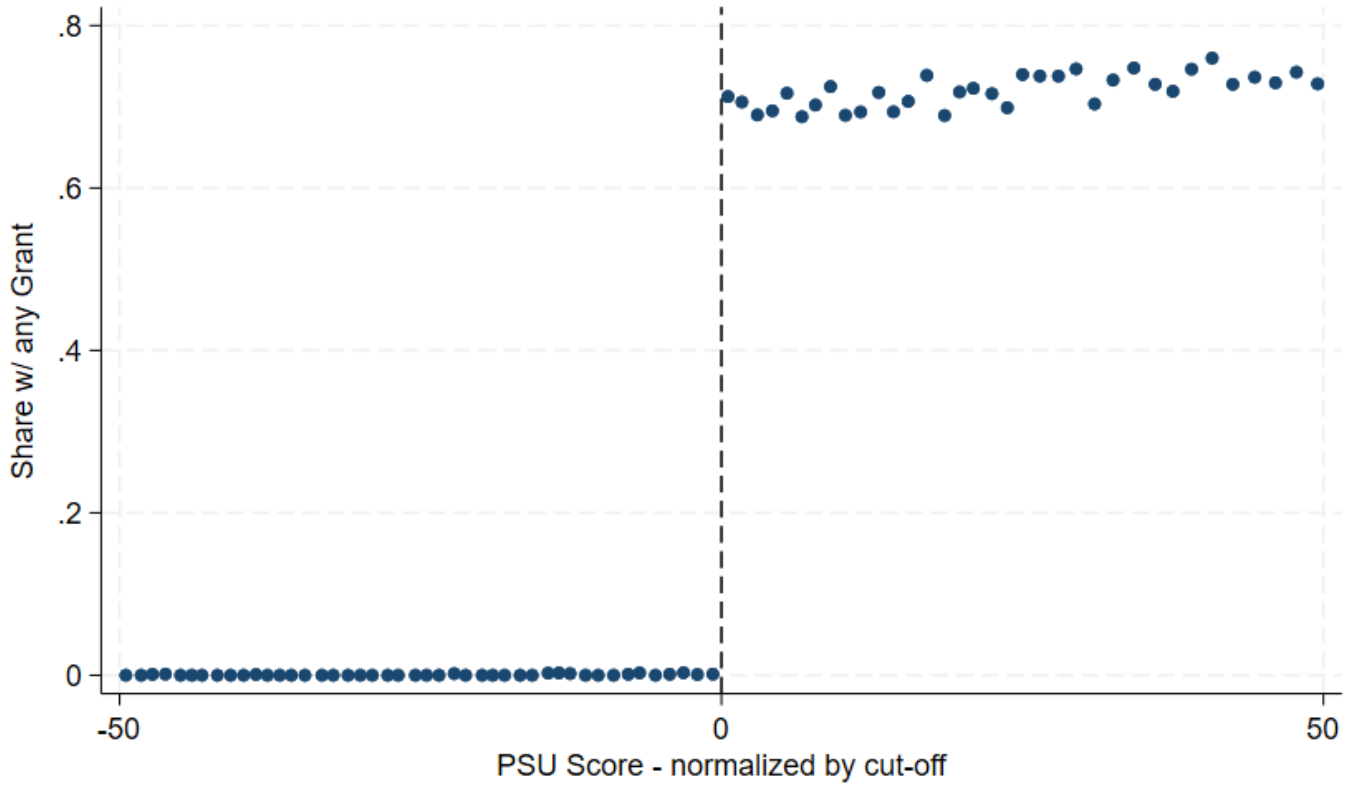
Figure: Take-up of any grant in 1.25 PSU point bins



Identification: No Sorting

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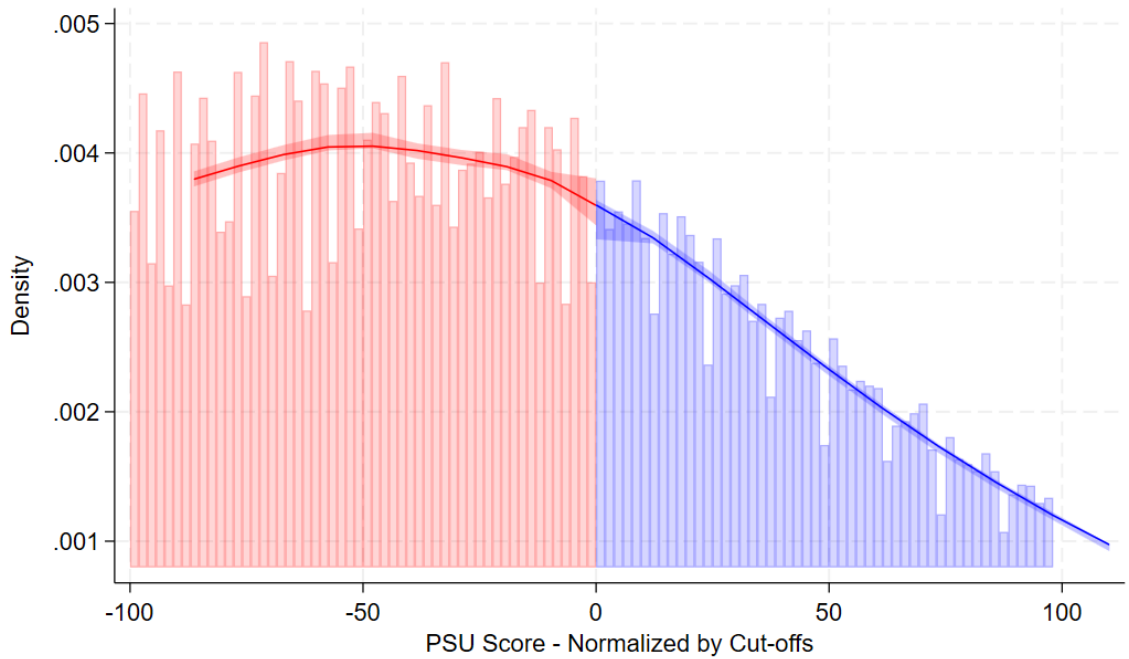
Figure: McCrary Test for Discontinuity in Running Variable



Identification: Continuity Potential Outcomes

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Table: Covariate Balance around Grant Eligibility Cut-off

	Baseline (β_0)	RD Estimate (β_1)	SE ($\hat{\beta}_1$)
High School GPA	5.725	0.002	0.008
# Working Family Members	1.159	-0.001	0.011
# Studying Family Members	0.100	-0.004	0.005
Female	0.540	0.004	0.007
Single Mother HH	0.188	-0.004	0.004
Academic Parents	0.445	-0.015**	0.009
Took Science Test	0.667	0.002	0.009
Municipal School	0.271	-0.007	0.004
Subsidized School	0.673	-0.010**	0.004
Academic School	0.809	-0.006	0.006

$^{**}p < 0.05$, $^{*}p < 0.10$.

Effect on STEM: by year and family income quintile

		Year 2012	Year 2013	Year 2014
Quintile 1	RD Estimate	0.034*		
		(0.018)		
	Baseline	0.243		
	PSU Cut-off	550		
	N	11,654		
Quintile 2	RD Estimate	0.013	0.042**	0.032**
		(0.024)	(0.017)	(0.014)
	Baseline	0.251	0.261	0.263
	PSU Cut-Off	550	525	525
	N	7,669	11,263	11,368
Quintile 3	RD Estimate	0.037*	0.027	0.006
		(0.021)	(0.019)	(0.020)
	Baseline	0.211	0.262	0.270
	PSU Cut-off	550	550	550
	N	5,777	7,772	7,911

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Effect on STEM: by year and family income quintile

Table: Effect of Grants vs. Loans on Enrollment in STEM, by Institution Types

	STEM in...		
	CRUCH	Private Uni	Vocational
RD_Estimate	0.020***	0.007**	0.001
	(0.005)	(0.003)	(0.004)
Baseline Mean	0.140	0.043	0.070
Bandwidth	50	50	50
Effective N	62,668	62,668	62,668

** $p < 0.05$, *** $p < 0.01$.

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Heterogeneity: Effect on STEM by Subgroups

		Gender	
	Male	Female	Δ of Coefficients
RD_Estimate	0.042***	0.020**	-0.022
	(0.013)	(0.008)	(0.015)
Baseline Mean	0.398	0.130	
Effective N	28,167	27,210	
		Parental Education	
	Second-Gen	First-Gen	Δ of Coefficients
RD_Estimate	0.025***	0.033***	0.008
	(0.009)	(0.010)	(0.013)
Baseline Mean	0.251	0.252	
Effective N	28,202	28,344	
		Parental Income	
	Quintile 2+3	First Quintile	Δ of Coefficients
RD_Estimate	0.028***	0.034**	0.006
	(0.008)	(0.017)	(0.019)
Baseline Mean	0.255	0.243	
Effective N	42,475	12,969	

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Placebo Test: RD Estimate on Non-Eligible Population

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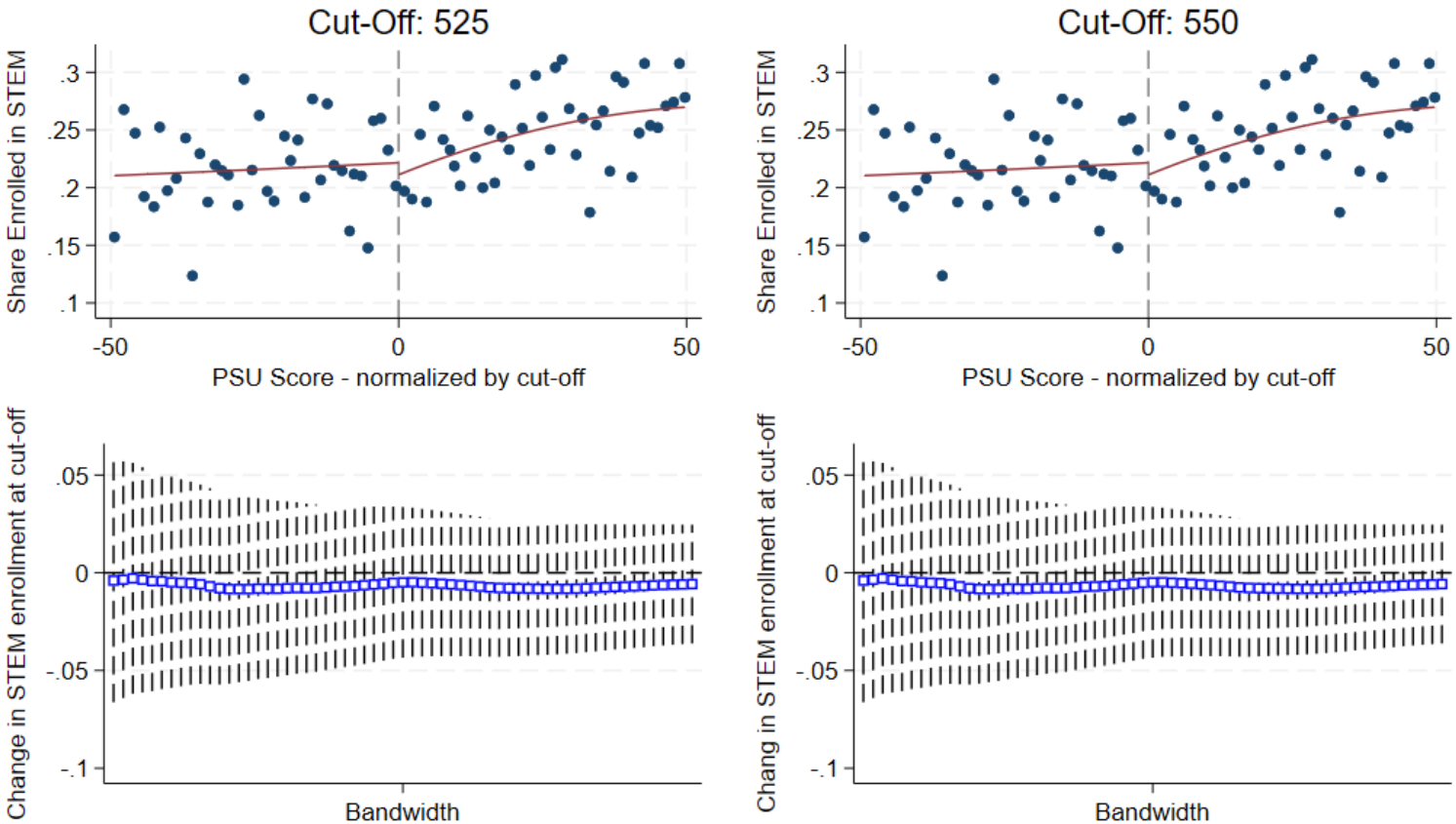

RD Estimates for Various Bandwidths

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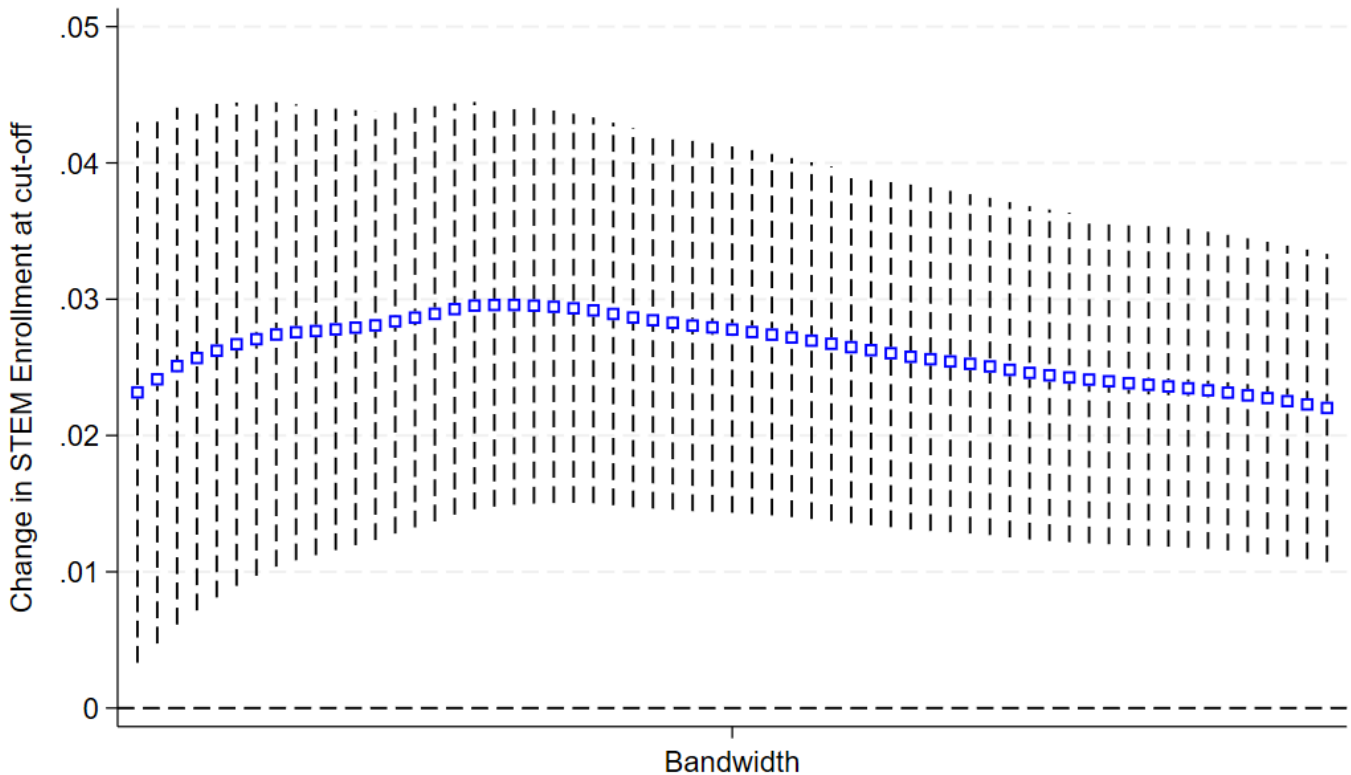
Figure: Effect on STEM Enrollment



RD Estimates on General Enrollment

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Table: Effect of Grants vs. Loans on Enrollment in Different Institution Types

	Enrolled in...			
	Any Institution	CRUCH	Private Uni	Vocational
RD_Estimate	0.032***	0.029***	0.009	-0.005
	(0.006)	(0.007)	(0.008)	(0.006)
Baseline Mean	0.797	0.357	0.295	0.146
Bandwidth	50	50	50	50
Effective N	62,668	62,668	62,668	62,668

** $p < 0.05$, *** $p < 0.01$.

Effect of Grant Eligibility on All Fields: Rescaled

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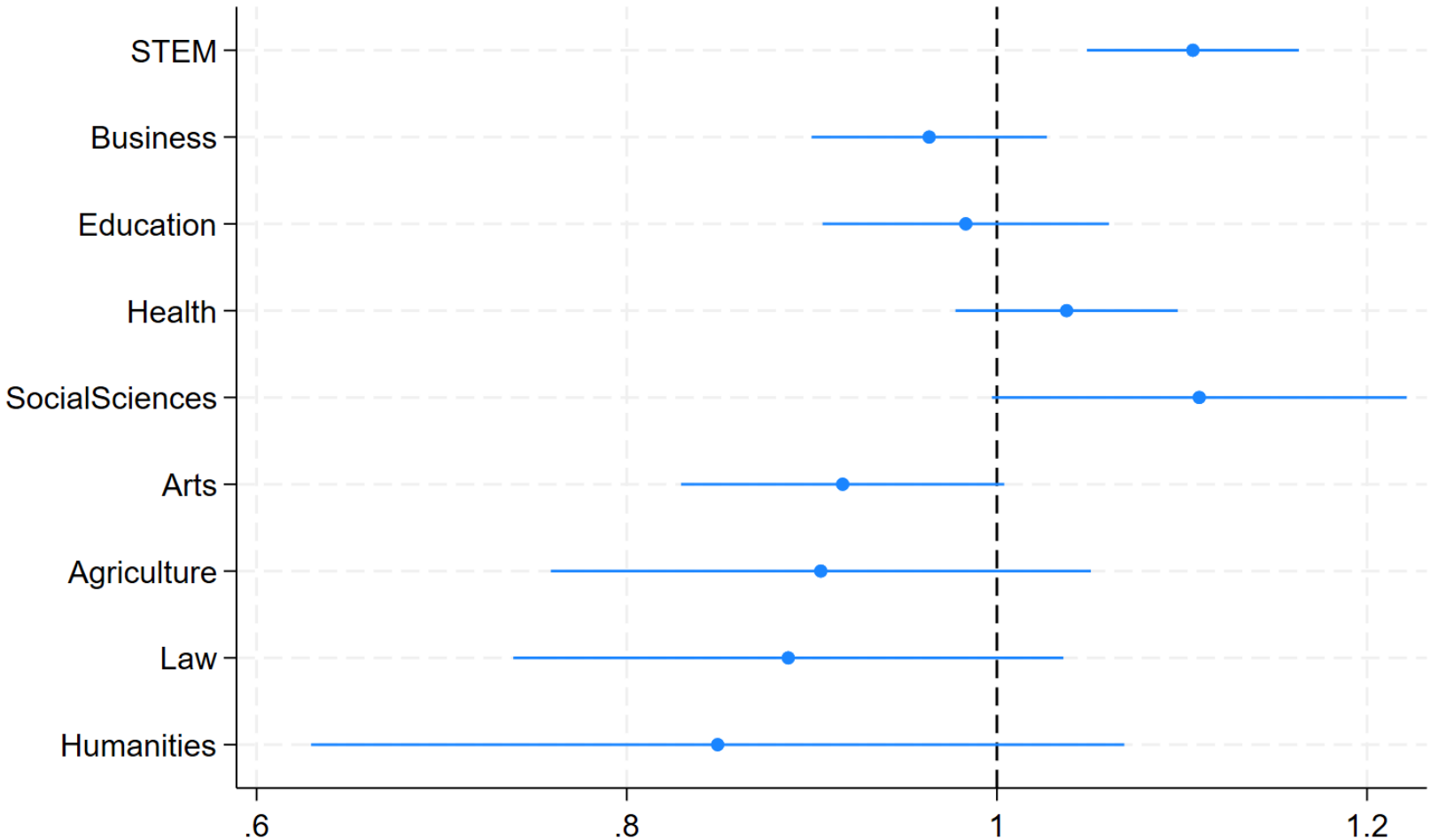
Figure: Effect of Grants vs. Loans: Coeff. rescaled by Baseline Enrollment



Financial Aid and STEM Subfields

Table: Results for STEM subfields: Engineering and Natural Sciences

	Engineering (=1)		Natural Sciences (=1)	
RD Estimate	0.022^{**}	0.021^{*}	0.005^{**}	0.006^{*}
	(0.009)	(0.011)	(0.002)	(0.003)
Baseline Mean	0.234	0.238	0.021	0.021
Bandwidth	43.3	25	49.9	25
Effective N	59,634	34,875	67,788	34,875

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Website Mifuturo

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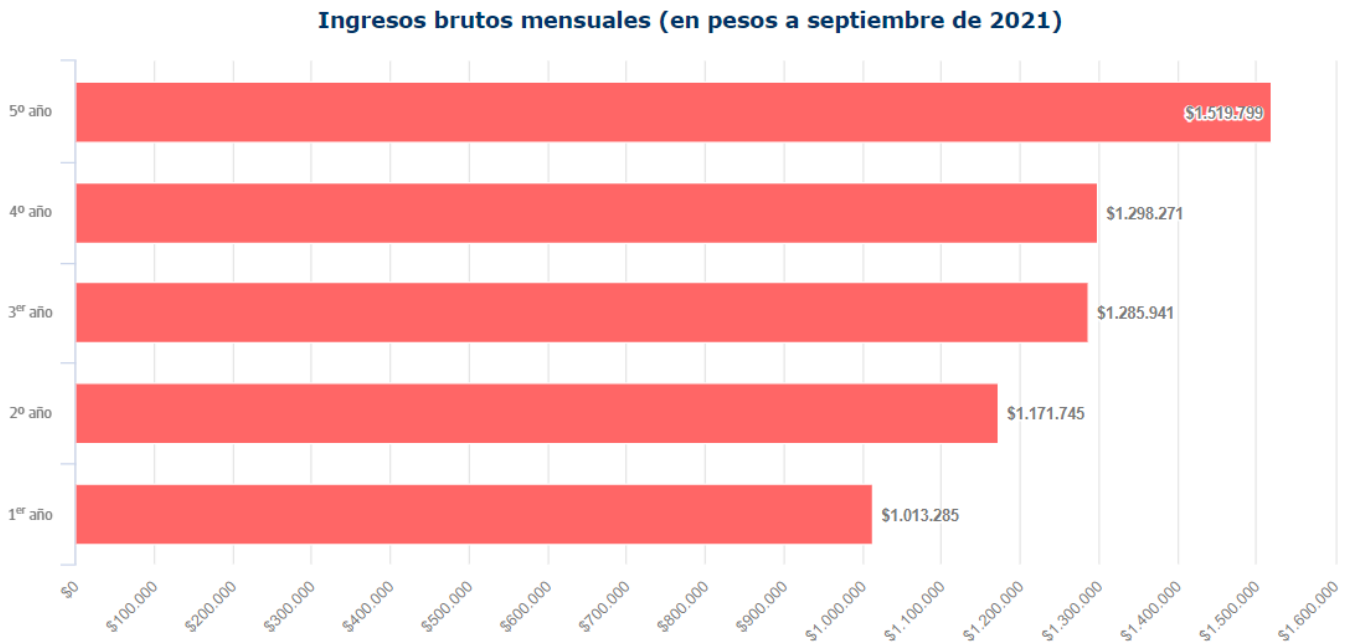
Ingreso Promedio | Tramos de Ingreso | Evolución Ingreso | Empleabilidad | Evolución Empleabilidad | Titulados | Matrícula y Retención | Establecimiento de Origen

Matemáticas y/o Estadísticas



Más Información

Number of Programs as a function of PSU

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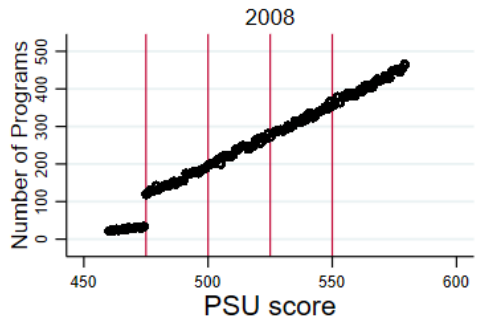

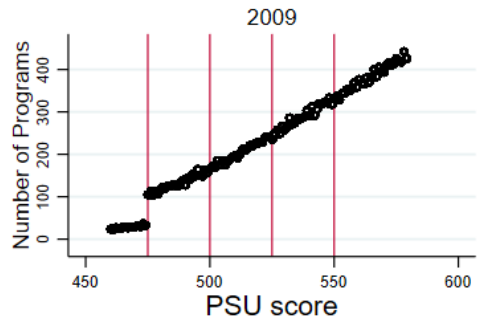

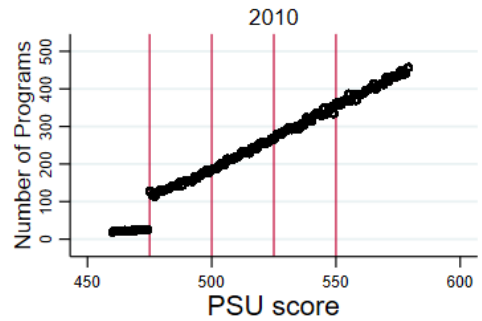

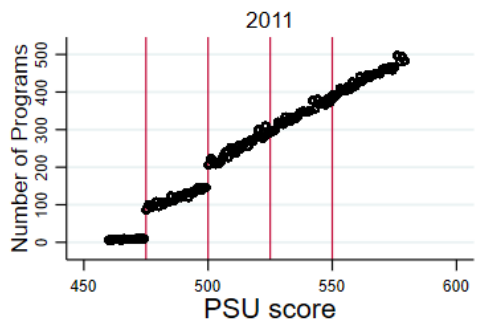

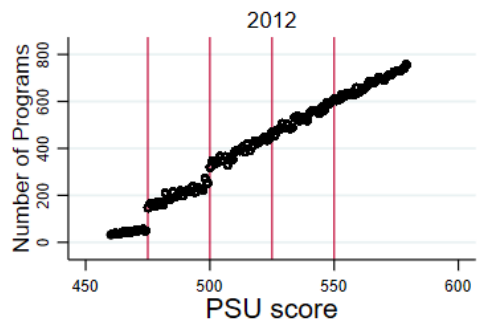

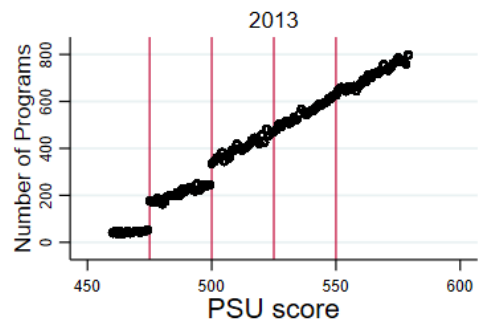

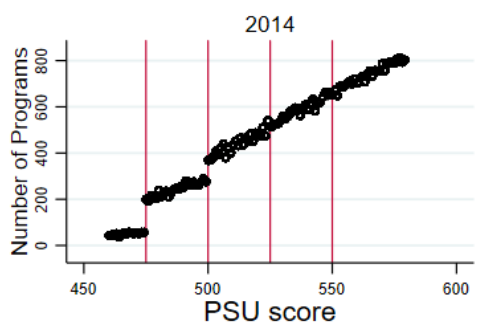

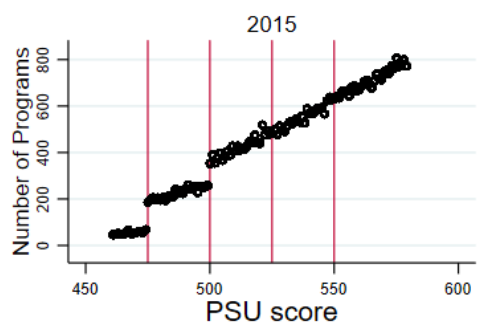

Increase Risk Taking and Graduation

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Table: Effect of Grants vs. Loans on Graduation Conditional on Enrollment

	Graduated in...		**Years to Completion in...**			
	Any	STEM	Any	Any	STEM	STEM
	(1)	(2)	(3)	(4)	(5)	(6)
RD Estimate	0.008	-0.004	0.071**	0.040	0.152**	0.075
	(0.010)	(0.013)	(0.035)	(0.026)	(0.068)	(0.057)
Baseline Mean	0.607	0.464	5.823	5.823	5.623	5.623
Bandwidth	63	79	38	47	62	67
Effective N	62,061	24,961	24,358	29,736	9,503	10,247
# Semester Req.			No	Yes	No	Yes

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.