The Effect of the Availabilty of Student Credit on Tuitions: Testing the Bennet Hypothesis using Evidence from a Large-Scale Student Loan Program in Brazil

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Outline

Introduction: Motivation

- We test whether the availability of student loans increases tuition costs, the *Bennet Hypothesis*.
- Does the availability of credit inflates asset prices in general?
- Policy implications for student indebtedness

Introduction: In a nutshell

- Reduced-form model:
  - Tuitions increased by some 15% in real terms from 2009 through 2012.
  - FIES eligible: 18%; non-FIES eligible: 10%.
- Structural demand estimation:
  - FIES penetration reduces the tuition elasticity .
  - Quantitative exercise
    - Half of the increase in tuitions can be attributed to a reduction in elasticity.

Related Literature

- **Constraints in credit markets for human capital investment**: Becker (1967), Cameron e Heckman (1998), Carneiro e Heckman (2002), Belley e Lochner (2007), Lochner e Monge-Naranjo (2011)
- **Empirical relevance of borrowing constraints on schooling choices**: Dinarsky (2000, 2003), Kane (2003), Urzua e Rau (2012)
- **Bennet Hypothesis**: Hoxby (1997), Schapiro, McPherson e Winston (1989), Dinarsky (2000), Long (2004)

Data

- *Censo do Ensino Superior* (Higher Education Census)
  - Annual survey on the universe of higher education institutions.
  - Detailed information on institutions' and students' characteristics.
- Hoper Educação
  - Unique proprietary database. Tuition at the major-city-school level
- Instituto Nacional de Estudos e Pesquisas Educacionais (INEP), Ministry of Education
  - Measure of quality: the *Conceito Preliminar de Curso* (CPC). CPC is defined through evaluations conducted every three years.
- Relação Anual de Informações Sociais (RAIS)
  - Wages. Firm-level detailed worker information. Formal sector.

FIES

- The *Fundo de Financiamento Estudantil* (FIES) is a major Brazilian Federal Government student-lending program.
- Lends to students in private higher education institutions.
- Created in 1999. In early 2010, the program gained practical relevance after substantial operational and normative changes.

FIES: the 2010 ramp-up: students' perspective

	Before 2010	After 2010
Subscription Period	Annual	Any
Annual Interest	6.5%	3.5%
Maximum L-t-V	100%	100%
Utilization Period	Duration	Duration; max pay R50 per quarter
Grace Period	12 m	18 m; max pay B50 per quarter
Amortization Period	After grad, 2x time financed	After grad, 3x time financed

FIES: the 2010 ramp-up

- Major changes (Universities' perspective):
  - Lower drop-out rates
  - Universities are paid in Treasury debt instruments reedemable for social security expenses, and for cash in repurchase auctions. After 2010: increased frequency of auctions.
  - Higher prices?

Figura: FIES - New Loans.

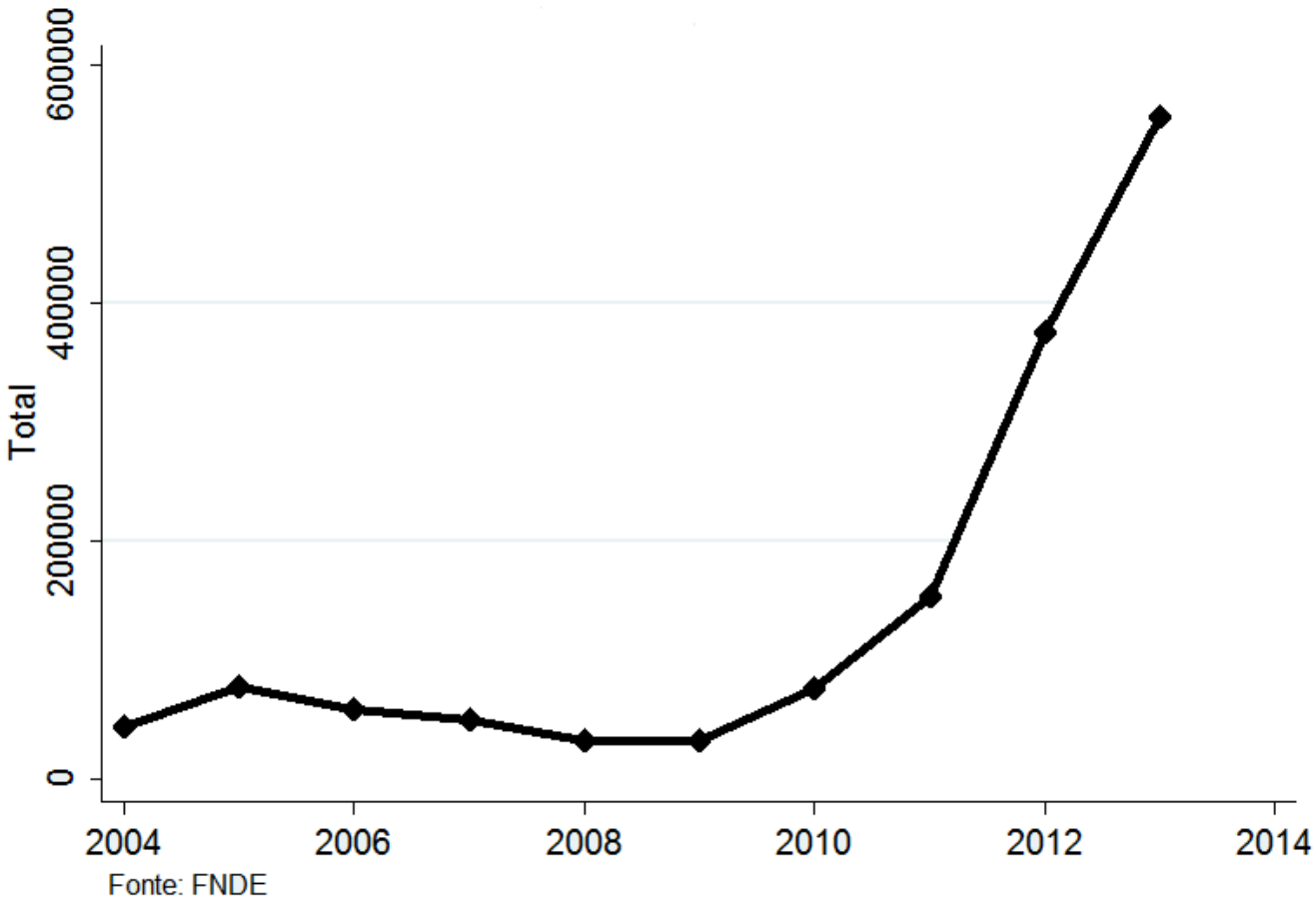
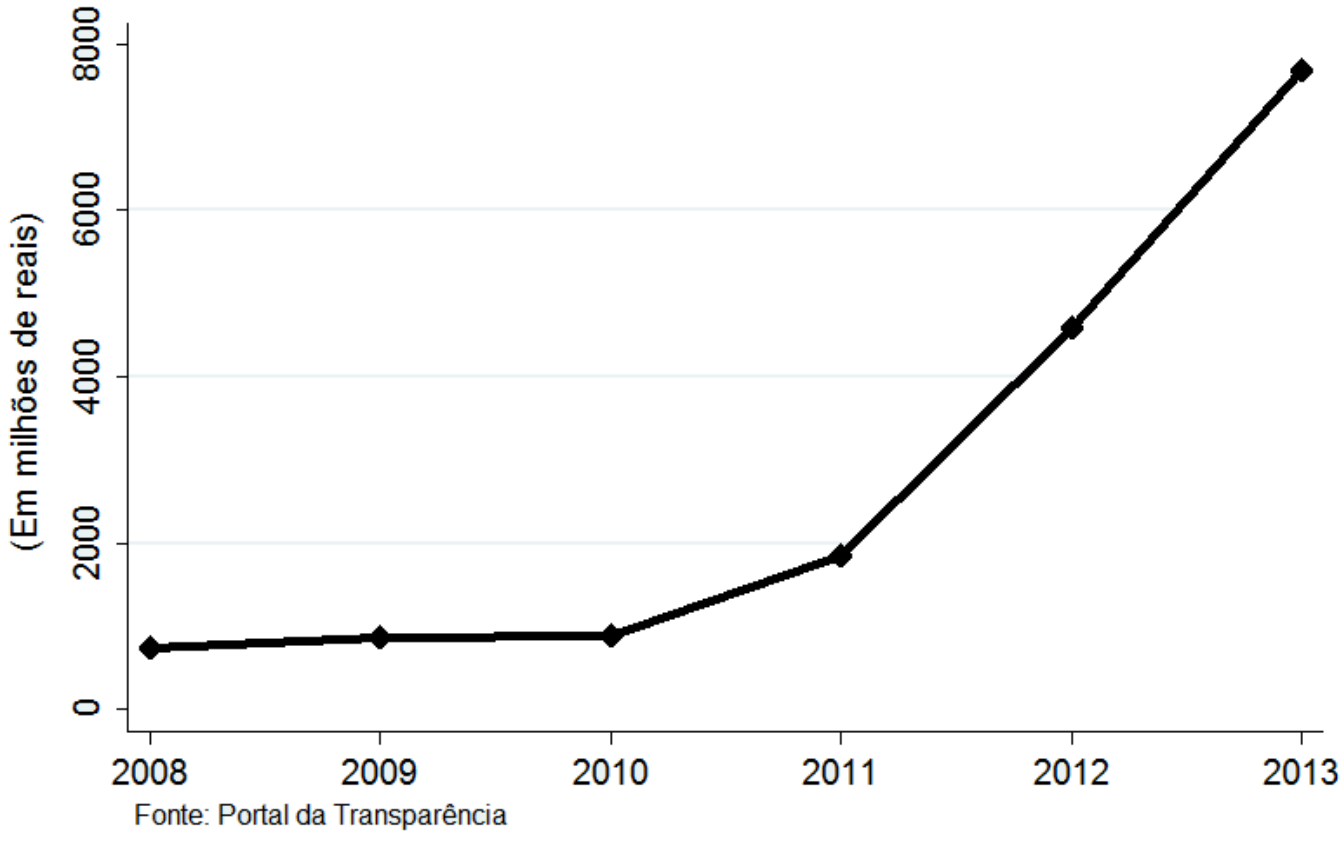


Figura: FIES - Government Expenses - millions of reais.



Reduced Form: Identification Strategy

- The FIES ramp-up provides a quasi-natural experiment.
- Eligibility: students in major-college pairs with score three or above on the the CPC.
  - CPC is a mixture of the score on the ENADE exam and school chacteristics inspected by the Ministry of Education
  - Before 2010: only ENADE determined eligibility
- Sudden decision to ramp-up the FIES in the end of 2009. Schools did not have sufficient time to react to it in the short-run

Reduced Form: Estimated Model

- Difference-in-differences strategy:
  - Treatment: eligible major-college in 2010 (CPC ≥ 3)
  - Control: non eligible major-college in 2010 (CPC < 3)
- Observations clustered at the major-college level

Reduced Form

$$log(Tuition)_{it} = \theta + \varphi D_t * Treatment_i + \rho X_{it} + \mu_t + \eta_i + \zeta_{it} \quad (1)$$

Reduced Form: Estimated Model

- With a little discontinuity flavor:
  - Treatment: eligible major-college in 2010 (CPC $= 3$)
  - Control: non eligible major-college in 2010 (CPC $= 2$)

Descriptive Statistics: Treatment and Control, Whole Sample

Descriptive Statistics

Variable	Treated - pre FIES	Control - pre FIES	Mean Diff - pvalue
Tuition (in 2008 Reais)[1] - Mean	580	515	3.17e-07
Tuition (in 2008 Reais)[1] - StDev	315	322	
Enrolled Students (Total)[1] - Mean	459	303	5.85e-10
Enrolled Students (Total)[1] -StDev	649	362	
Students with FIES loan (Total)[1] - Mean	18	8	1.13e-07
Students with FIES loan (Total)[1] -StDev	48	34	
% Students with Fies loan [1] - Mean	3.6	2.2	1.47e-08
% Students with Fies loan [1] - StDev	6.2	5.0	
Quality Indicator[1] - Mean	2.6	1.6	0
Quality Indicator[1] - StDev	0.5	0.4	
Applicant Students to Max Class Size [1] - Mean	1.73	1.55	.0806184
Applicant Students to Max Class Size [1] - StDev	2.99	2.18	
Faculty Quality[2] * - Mean	0.62	0.53	1.12e-21
Faculty Quality[2] * - StDev	0.16	0.17	
Degrees (Total)[2] - Mean	76	82	0.25
Degrees (Total)[2] - StDev	137	176	
Observations	3244	1012	

Descriptive Statistics: Treatment and Control, Only CPC 2 and 3, Pre Treatment

Descriptive Statistics - Reduced Sample

Variable	Treated - pre FIES	Control - pre FIES	Mean Diff - pvalue
Tuition (in 2008 Reais)[1] - Mean	551	517	0.003
Tuition (in 2008 Reais)[1] - StDev	291	326	
Enrolled Students (Total)[1] - Mean	441	307	1.80e-08
Enrolled Students (Total)[1] - StDev	607	367	
Students with FIES loan (Total)[1] - Mean	15	9	.0000211
Students with FIES loan (Total)[1] - StDev	40	35	
% Students with Fies loan [1] - Mean	3.4	2.3	2.87e-06
% Students with Fies loan [1] - StDev	6.3	5.0	
Quality Indicator[1] - Mean	2.40	1.72	0
Quality Indicator[1] - StDev	0.31	0.36	
Applicant Students to Max Class Size [1] - Mean	1.70	1.56	.18
Applicant Students to Max Class Size [1] - StDev	3.14	2.20	
Faculty Quality[2] * - Mean	0.59	0.54	2.17e-14
Faculty Quality[2] * - StDev	0.15	0.17	
Degrees (Total)[2] - Mean	78	80	0.59
Degrees (Total)[2] - StDev	143	173	
Observations	2569	970	

Descriptive Statistics: Treatment and Control, Only CPC 2 and 3, Post Treatment

Descriptive Statistics - Reduced Sample

Variable	Treated - post FIES	Control - post FIES	Mean Diff - pvalue
Tuition (in 2008 Reais)[1] - Mean	558	508	0.0002
Tuition (in 2008 Reais)[1] - StDev	326	314	
Enrolled Students (Total)[1] - Mean	430	297	2.43e-08
Enrolled Students (Total)[1] - StDev	574	354	
Students with FIES loan (Total)[1] - Mean	25	17	0.0002
Students with FIES loan (Total)[1] - StDev	55	48	
% Students with Fies loan [1] - Mean	6.0	3.8	0.002
% Students with Fies loan [1] - StDev	8.8	8.1	
Quality Indicator[1] - Mean	2.29	1.77	1.64e-37
Quality Indicator[1] - StDev	0.46	0.45	
Applicant Students to Max Class Size [1] - Mean	2.03	2.11	0.60
Applicant Students to Max Class Size [1] - StDev	3.55	5.65	
Faculty Quality[2] * - Mean	0.63	0.58	6.50e-13
Faculty Quality[2] * - StDev	0.14	0.16	
Degrees (Total)[2] - Mean	101	112	0.14
Degrees (Total)[2] - StDev	179	218	
Observations	2472	871	

Reduced Form: Validity of Assumptions

- Reduced-form: ζ_{it} contains unosberved demand and supply shifters.
  - Demand side: quality.
  - Supply side: quantites and scale.

Reduced Form: Validity of Assumptions

- Demand side: quality.
  - Introducing observed quality has little impact on results.
  - Sudden ramp-up, no time for adjustment to qualify.
  - Assestment of quality made every three years.

Reduced Form: Validity of Assumptions

Figura: ENADE - Kernel Density - Treatment Group, 2009, 2011 and 2012

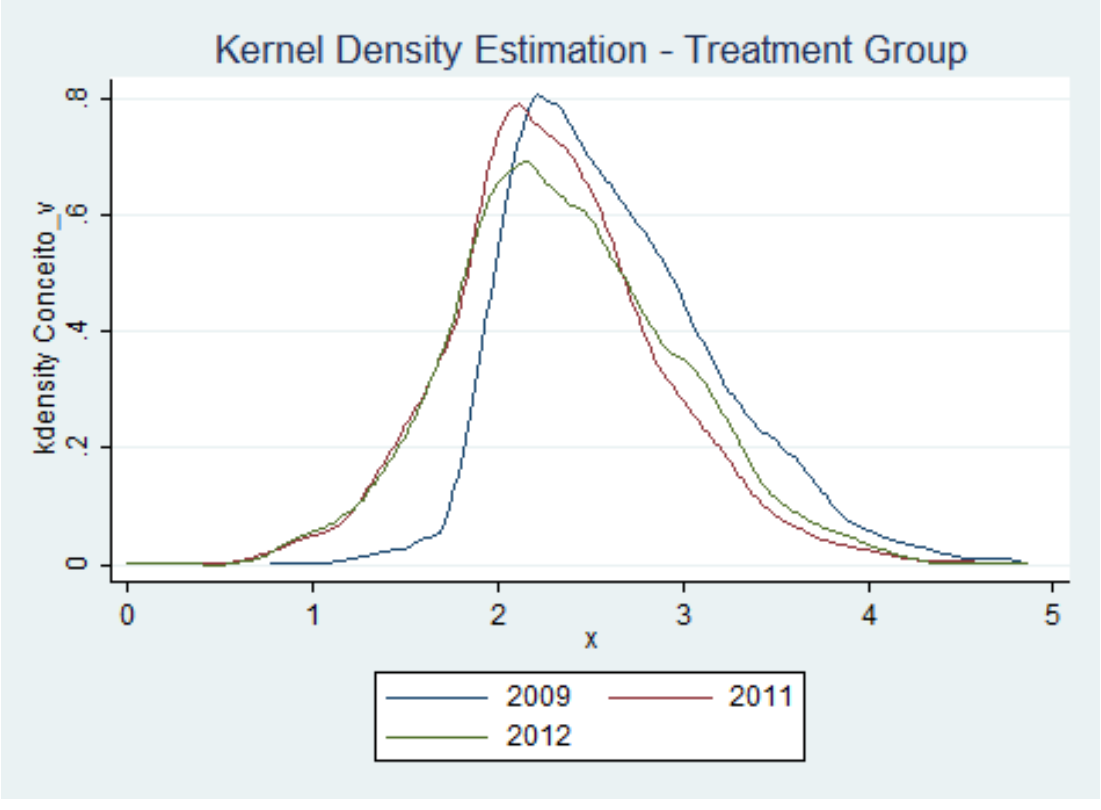
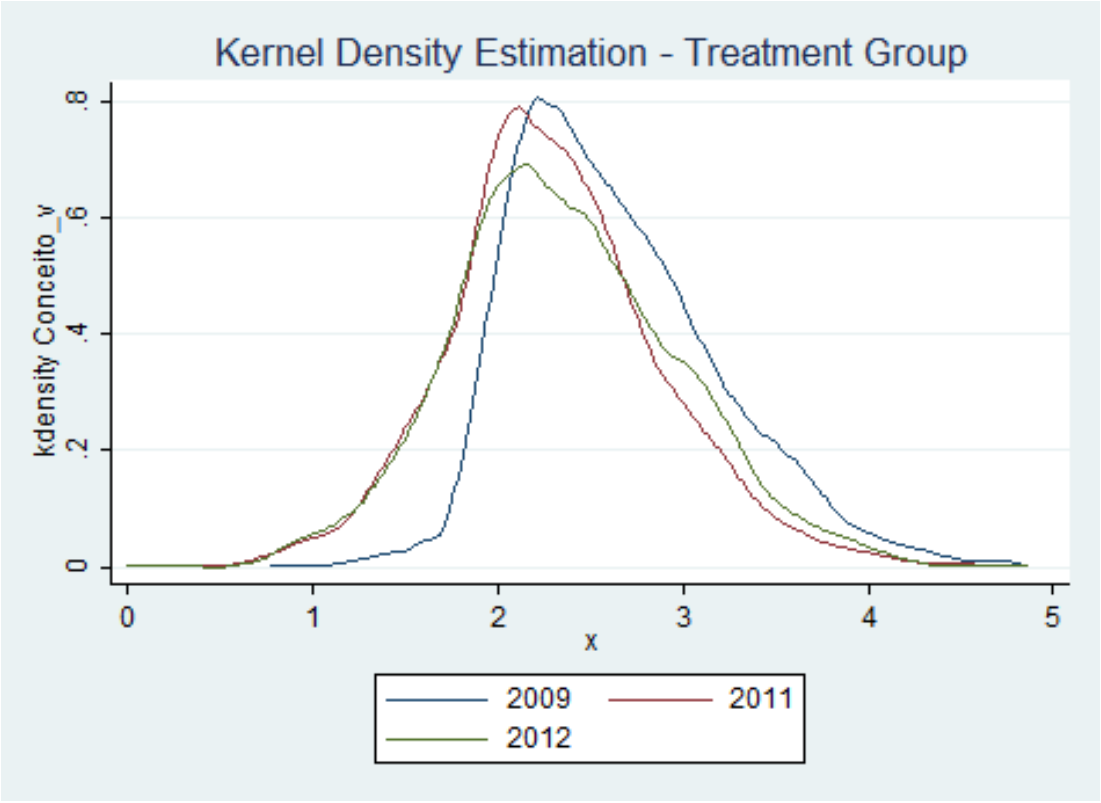
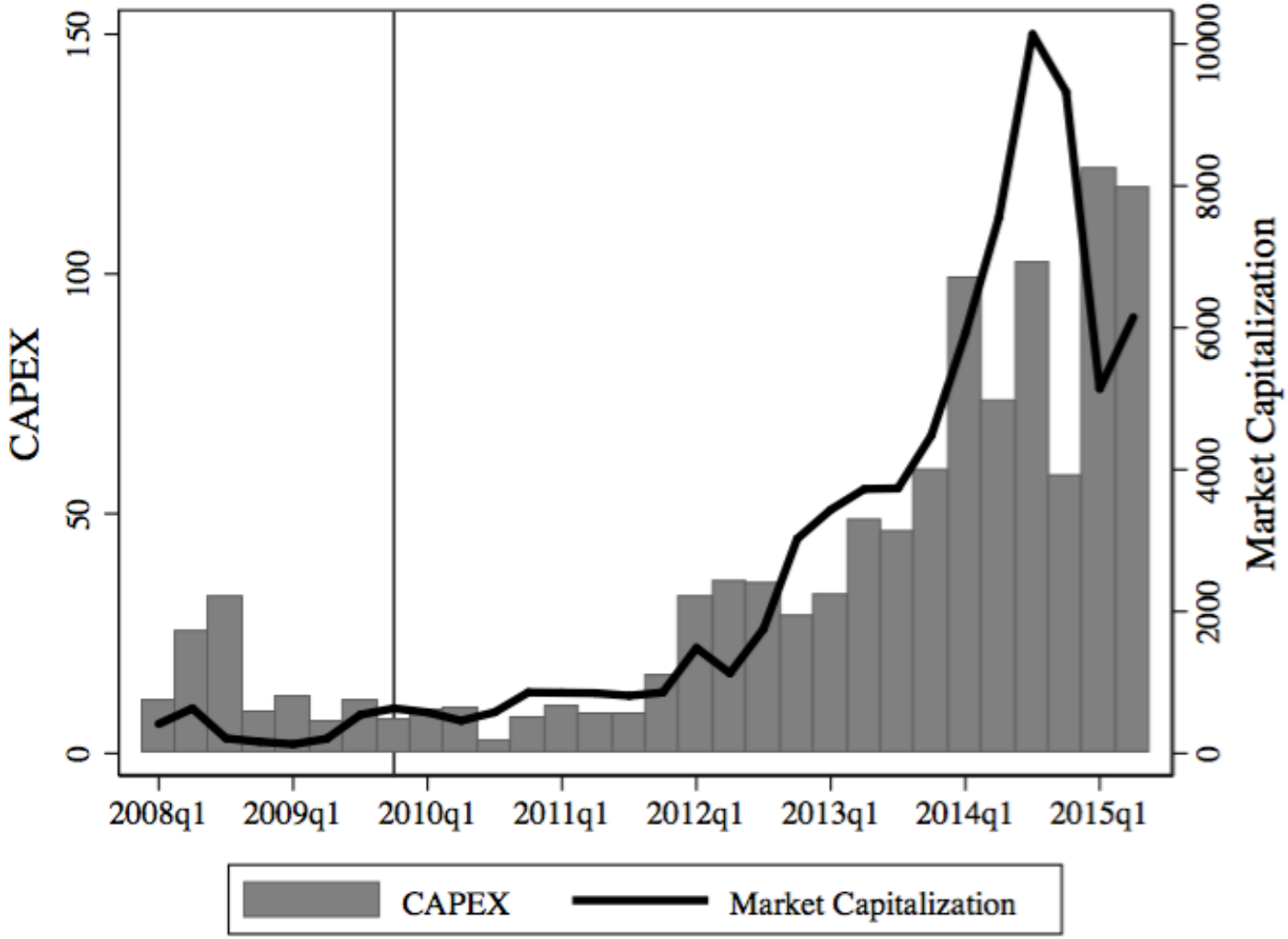


Figura: ENADE - Kernel Density - Control Group, 2009, 2011 and 2012



Reduced Form: Validity of Assumptions

Figura: Kroton: Market Capitalization and Capital Expenditures in USD million



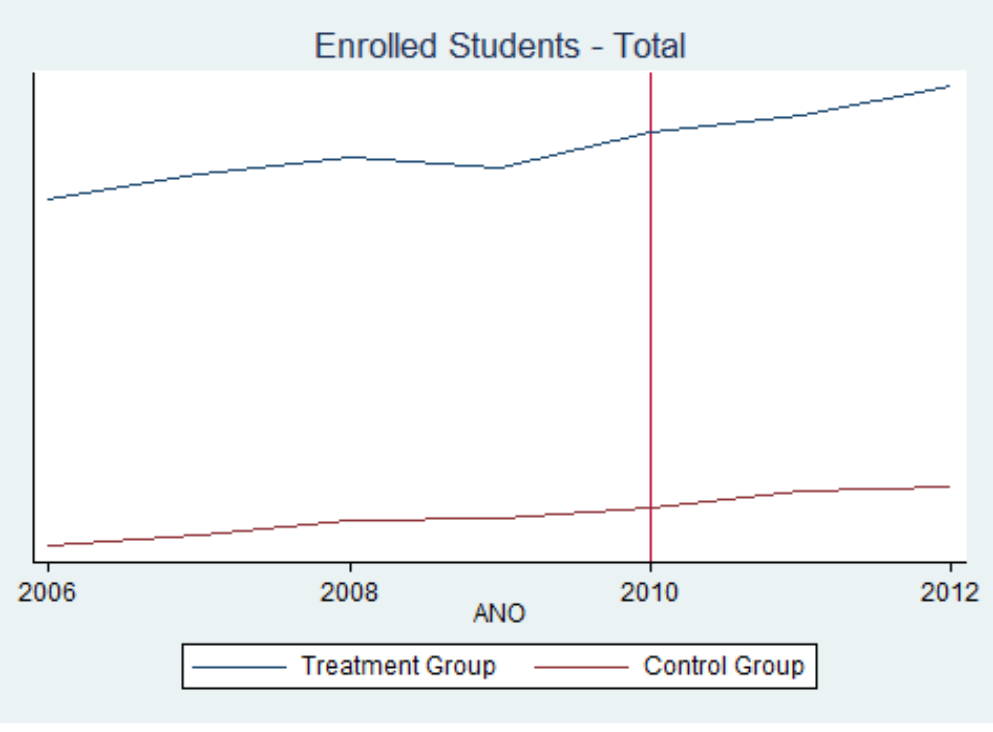
Source: Bloomberg and Economática

Reduced Form: Validity of Assumptions

- Supply side: quantity.
  - Differential increases in quantity prior to the 2010 ramp-up?

Reduced Form: Validity of Assumptions

Figura: Enrolled Students, Treatment and Control

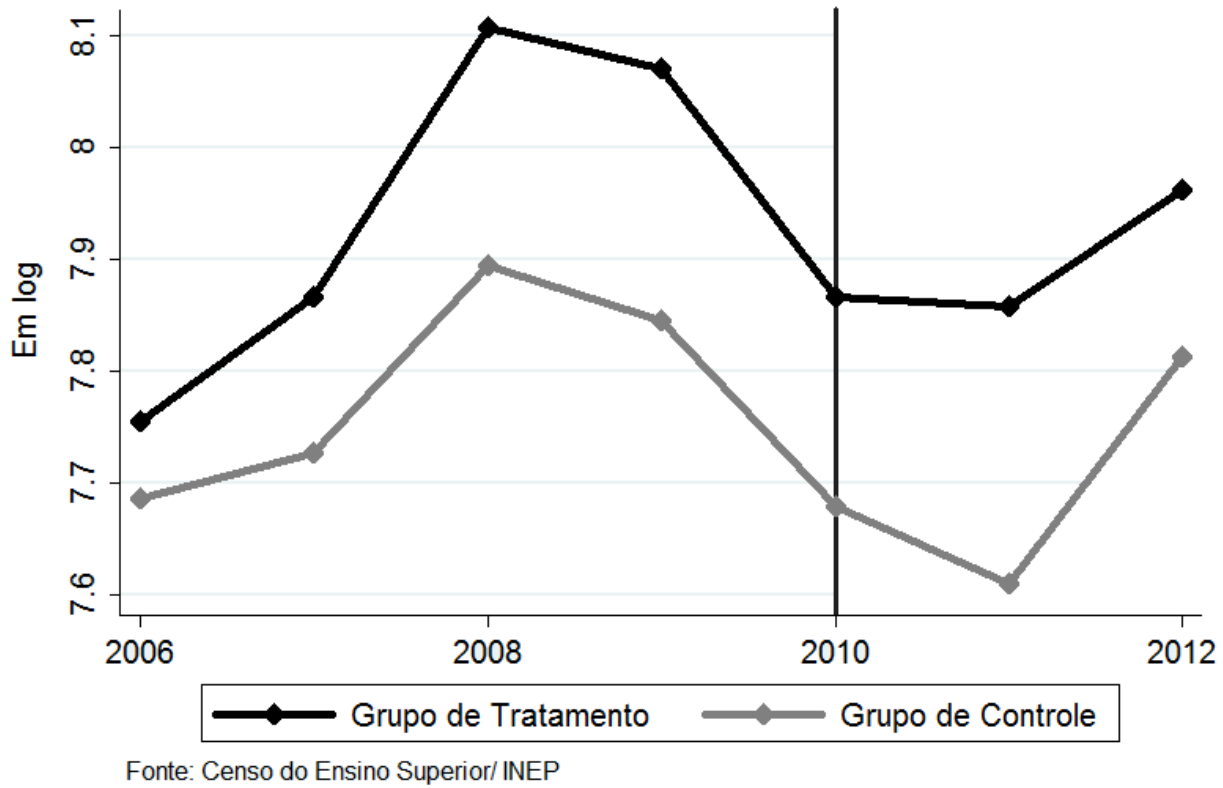


Reduced Form: Validity of Assumptions

- Parallel Trends?
  - Use financial data from the census to go before 2009

Reduced Form: Validity of Assumptions

Figura: Log Revenue per Student.



Fonte: Censo do Ensino Superior/ INEP

Reduced Form: Results

Reduced Form: Results, Whole Sample

VARIABLES	(1) DD	(2) DD	(3) DD	(4) DD	(5) DD	(6) DD	(7) DD
Treatment effect - (FIES x Dt)	0.110***	0.072***	0.063***	0.067***	0.063***	0.058***	0.056***
	(0.030)	(0.018)	(0.018)	(0.017)	(0.018)	(0.016)	(0.015)
Dt	0.020	0.094***	0.096***	0.094***	0.096***	0.082***	0.122***
	(0.023)	(0.024)	(0.025)	(0.024)	(0.024)	(0.014)	(0.015)
Enrolled Students (Total)[1]				0.0001***	1.69e-05	9.11e-05***	-3.85e-06
				(2.05e-05)	(2.86e-05)	(1.92e-05)	(2.59e-05)
Applicant Students to Max Class Size (Ratio)[1]				0.0092***	-0.00022	0.0102***	-0.000327
				(0.00308)	(0.000813)	(0.00305)	(0.000742)
Faculty Quality[2] *						0.501***	-0.144**
						(0.0518)	(0.0715)
Degrees (Total)[2]						-0.0001***	-0.0008***
						(0.0002)	(0.0003)
Administrative Staff (Total)[2]						0.0001***	7.49e-05*
						(1.90e-05)	(3.98e-05)
Faculty (Total)[2]						1.34e-05	-5.22e-06
						(8.98e-06)	(8.19e-06)
Constant	6.316***	6.290***	6.312***	6.241***	6.306***	5.946***	6.408***
	(0.017)	(0.015)	(0.012)	(0.017)	(0.013)	(0.031)	(0.073)
Major - College Fixed Effects	n	n	y	n	y	n	y
Year Fixed Effects	n	y	y	y	y	y	y
Observations	14,345	14,345	14,345	14,345	14,345	14,345	14,345
R-squared	0.013		0.119		0.119		0.138
Number of CO_CURSO		6,828	6,828	6,828	6,828	6,828	6,828

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
[1] Variables on major-college level
[2] Variables on college level

Reduced Form: Results, only CPC 2 and 3

Reduced Form Estimation

VARIABLES	(1) DD	(2) DD	(3) DD	(4) DD	(5) DD
Treatment effect - (FIES x Dt)	0.101***	0.100***	0.152***	0.154***	0.110***
	(0.032)	(0.032)	(0.027)	(0.025)	(0.021)
Dt	0.020	0.061**	-0.046**	-0.053***	-0.041**
	(0.024)	(0.030)	(0.021)	(0.020)	(0.017)
Enrolled Students (Total)[1]				3.33e-05	9.73e-06
				(2.49e-05)	(1.83e-05)
Applicant Students to Max Class Size (Ratio)[1]				0.021***	0.022***
				(0.005)	(0.005)
Faculty Quality[2] *					0.668***
					(0.068)
Degrees (Total)[2]					-0.0005**
					(0.0002)
Administrative Staff (Total)[2]					7.16e-05
					(5.20e-05)
Faculty (Total)[2]					-2.13e-05
					(6.08e-05)
Year Fixed Effects	n	y	y	y	y
Major Fixed Effects	n	n	y	y	y
Constant	6.279***	6.294***	6.619***	6.605***	6.115***
	(0.0181)	(0.0239)	(0.194)	(0.191)	(0.173)
Observations	6,882	6,882	6,882	6,882	6,882
R-squared	0.017	0.021	0.380	0.414	0.475

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Reduced Form: Robustness and Placebos

- Use financial data at the college level.
  - Treatment: proportion of majors eligible as of 2010 above media
  - Potential problem: differential composition effects for treatment and control
  - Observations clustered at the college level.
  - Also serve as placebo tests

Reduced Form: Robustness and Placebos

Tabela: Robustness - Placebo

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2006-2010 vs. 2011-2012	2007 2006 vs. 2010 2009 2008	2007 2006 vs. 2009 2008	2007 vs. 2009 2008	2007 vs. 2008	2007 vs. 2006	2010 vs. 2009 2008 2007 2006
Treatment effect - (FIES x Dt)	0.124*	0.0284	0.0214	0.0457	-0.0409	0.0492	0.0598
	(0.0702)	(0.101)	(0.112)	(0.138)	(0.166)	(0.152)	(0.0946)
Dt	-0.0493	0.0165		0.134	0.242**	0.0504	0.00299
	(0.0585)	(0.0725)		(0.0885)	(0.104)	(0.0994)	(0.0671)
Enrolled Students	-3.18e-05***	-2.65e-05***	-2.78e-05***	-2.62e-05**	-3.09e-05**	-1.75e-05	-2.64e-05***
	(6.75e-06)	(7.89e-06)	(8.93e-06)	(1.15e-05)	(1.41e-05)	(1.69e-05)	(7.89e-06)
Applicant Students to Max Class Size (Ratio)	0.0388***	0.0432***	0.0441***	0.0257**	0.105***	0.147***	0.0432***
	(0.00772)	(0.00925)	(0.0106)	(0.0114)	(0.0277)	(0.0269)	(0.00925)
Faculty Quality	0.481***	0.624***	0.618***	0.632***	0.511**	0.591***	0.625***
	(0.0838)	(0.0998)	(0.111)	(0.147)	(0.200)	(0.180)	(0.0990)
Majors - Total	-0.00402**	-0.00453**	-0.00509**	-0.00121	-0.00227	-0.0116***	-0.00456**
	(0.00159)	(0.00188)	(0.00210)	(0.00299)	(0.00376)	(0.00388)	(0.00188)
Administrative Staff (Total)	0.000574***	0.000534***	0.000538***	0.000615***	0.000572	0.000462	0.000532***
	(0.000132)	(0.000154)	(0.000174)	(0.000217)	(0.000351)	(0.000311)	(0.000154)
Faculty (Total)	0.000959***	0.000889***	0.000968***	0.000448	0.000782*	0.00152***	0.000893***
	(0.000180)	(0.000205)	(0.000227)	(0.000301)	(0.000411)	(0.000395)	(0.000205)
Constant	7.394***	7.333***	7.339***	7.420***	7.355***	7.190***	7.331***
	(0.0512)	(0.0587)	(0.0633)	(0.0800)	(0.105)	(0.0906)	(0.0574)
Observations	8,932	6,504	5,180	4,108	2,651	2,131	6,504
R-squared	0.037	0.044	0.049	0.032	0.078	0.106	0.044
Number of CO_IES	1,955	1,948	1,943	1,887	1,870	1,337	1,948

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Time and Higher Education Institution fixed effects included in all specifications.

Structural Form

- Reduced form: the availability of FIES increases tuition. Mechanisms:
  - Credit-constrained students: FIES shifts demands for tertiary education for a given level of tuition. Increasing marginal costs produce results.
  - Demand rotates: FIES changes the demand tuition-elasticity of tertiary education. Prices increase if less than perfect competition

Structural Form

- Let $t = 1, ...T$ be T markets, and $k = 1, ..., K$ de K different major-college pairs, and $i = 1, ...I$ be I consumers. We define a market as a county-year pair. Student i's indirect utility if she goes to major-collegel k in market t, U_{ikt}, is given by

Conditional Indirect Utility of i

$$U_{ikt} = \delta_{kt} + \epsilon_{ikt} \tag{2}$$

Mean Utility of i

$$\delta_{kt} \equiv X_{kt}\beta - \alpha p_{kt} + \omega FIES_{kt} + \lambda FIES_{kt} * p_{kt} + \xi_{kt} \tag{3}$$

Structural Form

- Assumption 1: students choose one major-college pair only. Comment on outside option.
- Assumption 2: ϵ_{ikt} is multinomal logit.
- Assumption 3: ϵ_{ikt} is i.i.d.. Comment on Independence of Irrelevant Alternatives.

Structural Form

- Given a vector $Kx1$ of mean utilities, students choose the major-college pair k if and only if k yields the highest utility.
- Let $A_k(\delta_{1t}, ..., \delta_{Kt})$ be the realizations of $\epsilon_{i1t}, ..., \epsilon_{iKt}$ such that k is the best option

Determination of the market share 1

$$A_k(\delta_{1t}, ..., \delta_{Kt}) = \{\epsilon_{i1t}, ..., \epsilon_{iKt} : \delta_{kt} + \epsilon_{ikt} \geq \delta_{vt} + \epsilon_{ivt} \; \forall \, v \neq k\} \quad (4)$$

Determination of the market share 2

$$s_{kt} \equiv s(\delta_{kt}) = Pr[A_k(\delta_{1t}, ..., \delta_{Kt})] \quad (5)$$

Structural Form

- Integrating out with respect to ϵ_{ikt}. Closed-form formula for the market shares.

Market Shares: i.i.d. Multinomial Logit

$$s_{kt} = \frac{exp(\delta_{kt})}{1 + \sum_{v=1}^{K} exp(\delta_{vt})} \tag{6}$$

- The own-elasticity is given by:

Own- Elasticity

$$\frac{\partial s_{kt} p_{kt}}{\partial p_{kt} s_{kt}} = (-\alpha + \lambda * FIES_{kt}) p_{kt} (1 - s_{kt}) \tag{7}$$

Structural Form

- Taking logs in (4) and subtracting the share of the outside option (s_{0t}), we have a regression model:

Regression Model

$$ln(s_{kt}) - ln(s_{0t}) = X_{kt}\beta - \alpha p_{kt} + \omega FIES_{kt} + \lambda FIES_{kt} * p_{kt} + \xi_{kt} \quad (8)$$

Structural Form

- ξ_{kt} is clearly endogenous. Need instruments for p_{kt}, $FIES_{kt}$ and $FIES_{kt} \times p_{kt}$
  - Average Tuition$_{-ht}$: Mean tuition in market k of majors in field h, excluding major k.
  - Mean Wage - Faculty: Mean wage of workers employed as instructors in in higher education institutions in market k.
  - Mean Wage - Administrative Staff: Mean wage of workers employed as administrative staff in market k.
  - Higher Education Institution Eligible for FIES (*dummy*) : a *dummy* that equals 1 if the school has at least one student financed with FIES
  - Degree Eligible for FIES (*dummy*): *dummy* that equals 1 if the major-school is eligible for FIES

Structural Form: Results

First Stage: Tuition

	(1)	(2)	(3)	(4)	(5)
	Tuition (in 2008 Reais)[1]				
Enrolled Students (Total)[1]				0.0320***	0.0179**
				(0.00781)	(0.00847)
Applicant Students to Max Class Size (Ratio)[1]				36.85***	37.12***
				(5.235)	(5.216)
Faculty Quality[2] *					287.4***
					(56.58)
Degrees (Total)[2]					-0.518***
					(0.0841)
Administrative Staff (Total)[2]					0.0571***
					(0.0199)
Faculty (Total)[2]					-0.00693
					(0.0162)
Mean Wage Faculty[3]	0.0424**	0.0446**	0.0217**	0.0170**	0.0207**
	(0.0170)	(0.0174)	(0.0101)	(0.00799)	(0.00925)
Mean Wage Administrative Staff[3]	-0.00577	-0.00379	-0.0123	-0.0244*	-0.0341***
	(0.0239)	(0.0249)	(0.0133)	(0.0139)	(0.0107)
$(\text{Average Tuition})^3_{-ht}$	0.270**	0.234**	0.375***	0.346***	0.236***
	(0.108)	(0.111)	(0.0701)	(0.0620)	(0.0630)
Higher Education Institution Qualified for FIES (dummy)[2]	51.65	48.34	-88.57*	-97.16**	-112.0***
	(57.68)	(57.64)	(45.76)	(46.55)	(39.74)
dummyCURSO_HAB	-87.27	-96.18	-91.64**	-100.5**	-97.73***
	(60.32)	(60.31)	(44.89)	(39.93)	(36.21)
$((AvgTuition)^3_{-ht})x(HEIQualifiedforFIES(dummy)^2)$	0.0852	0.100	0.214***	0.239***	0.230***
	(0.101)	(0.105)	(0.0711)	(0.0663)	(0.0579)
$((AvgTuition)^3_{-ht}) \times (DegreeQualifiedforFIES(dummy)^1)$	0.139	0.140	0.162**	0.171***	0.150***
	(0.0918)	(0.0923)	(0.0654)	(0.0579)	(0.0532)
$(MeanWageFaculty^3) \times (HEIQualifiedforFIES(dummy)^2)$	-0.0121	-0.0123	-0.0159	-0.0146	-0.0196
	(0.0244)	(0.0245)	(0.0165)	(0.0138)	(0.0150)
$(MeanWageFaculty^3) \times (DegreeQualifiedforFIES(dummy)^1)$	-0.00735	-0.00674	0.000404	0.00409	-0.00142
	(0.0191)	(0.0189)	(0.0144)	(0.0107)	(0.00943)
$(MeanWageAdmStaff^3) \times (HEIQualifiedforFIES(dummy)^2)$	0.00162	0.00150	0.0132	0.00338	0.0215
	(0.0553)	(0.0556)	(0.0318)	(0.0338)	(0.0247)
$(MeanWageAdmStaff^3) \times (DegreeQualifiedforFIES(dummy)^1)$	0.0570	0.0594	0.0480*	0.0413	0.0385
	(0.0412)	(0.0413)	(0.0285)	(0.0263)	(0.0237)
Constant	227.6***	225.1***	329.0*	355.4*	255.4
	(36.35)	(35.33)	(194.8)	(194.4)	(204.9)
Year Fixed Effects	n	y	y	y	y
Major Fixed Effects	n	n	y	y	y
Observations	14,345	14,345	14,345	14,345	14,345
R-squared	0.067	0.069	0.314	0.457	0.485

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First Stage: FIES Penetration

	(1)	(2)	(3)	(4)	(5)	(6)
	Students with Fies loan to Enrolled Students Ratio [1]					
Enrolled Students (Total)[1]				2.52e-06	2.08e-06	
				(3.58e-06)	(2.86e-06)	
Applicant Students to Max Class Size (Ratio)[1]				0.00404***	0.00407***	
				(0.000692)	(0.000684)	
Faculty Quality[2] *					0.0107	
					(0.0117)	
Degrees (Total)[2]					-4.79e-05	
					(3.30e-05)	
Administrative Staff (Total)[2]					1.80e-05***	
					(4.74e-06)	
Faculty (Total)[2]					-1.29e-05***	
					(3.39e-06)	
Mean Wage Faculty[3]	1.23e-08	-1.59e-06	-3.61e-06	-4.10e-06	-3.42e-06	
	(1.63e-06)	(1.95e-06)	(2.44e-06)	(2.54e-06)	(2.45e-06)	
Mean Wage Administrative Staff[3]	8.37e-06*	4.19e-06	4.13e-06	2.87e-06	2.57e-06	
	(5.07e-06)	(4.00e-06)	(4.53e-06)	(4.66e-06)	(5.04e-06)	
$(\text{Average Tuition})^3_{-ht}$	-3.04e-05	7.62e-06	2.47e-05	2.14e-05	1.54e-05	
	(1.96e-05)	(1.93e-05)	(2.18e-05)	(2.18e-05)	(2.28e-05)	
Higher Education Institution Qualified for FIES (dummy)[2]	0.0644***	0.0734***	0.0546***	0.0536***	0.0525***	
	(0.0135)	(0.0143)	(0.0139)	(0.0136)	(0.0136)	
dummyCURSO_HAB	0.0191	0.0255**	0.0262**	0.0252**	0.0254**	
	(0.0126)	(0.0124)	(0.0124)	(0.0124)	(0.0128)	
$((AvgTuition)^3_{-ht})x(HEIQualifiedforFIES(dummy)^2)$	1.31e-05	-8.58e-06	1.17e-05	1.46e-05	1.18e-05	
	(3.14e-05)	(3.13e-05)	(3.17e-05)	(3.12e-05)	(3.19e-05)	
$((AvgTuition)^3_{-ht}) \times (DegreeQualifiedforFIES(dummy)^1)$	3.03e-05	2.82e-05	3.11e-05	3.21e-05	3.19e-05	
	(3.21e-05)	(3.06e-05)	(2.93e-05)	(2.93e-05)	(2.95e-05)	
$(MeanWageFaculty^3) \times (HEIQualifiedforFIES(dummy)^2)$	3.01e-06	1.85e-06	4.94e-07	6.38e-07	-1.12e-07	
	(3.87e-06)	(4.15e-06)	(4.15e-06)	(3.90e-06)	(3.91e-06)	
$(MeanWageFaculty^3) \times (DegreeQualifiedforFIES(dummy)^1)$	-2.33e-07	-8.73e-07	-4.90e-07	-1.01e-07	-5.71e-07	
	(2.59e-06)	(2.59e-06)	(2.30e-06)	(2.25e-06)	(2.17e-06)	
$(MeanWageAdmStaff^3) \times (HEIQualifiedforFIES(dummy)^2)$	-1.68e-05*	-1.76e-05*	-1.64e-05*	-1.74e-05*	-1.50e-05	
	(9.76e-06)	(9.93e-06)	(9.59e-06)	(9.27e-06)	(9.16e-06)	
$(MeanWageAdmStaff^3) \times (DegreeQualifiedforFIES(dummy)^1)$	-1.30e-05	-1.46e-05	-1.59e-05	-1.66e-05	-1.68e-05	
	(1.02e-05)	(9.65e-06)	(1.08e-05)	(1.08e-05)	(1.06e-05)	
Constant	-0.00692	0.0199***	0.00207	0.00476	0.00140	
	(0.00713)	(0.00752)	(0.0103)	(0.00982)	(0.0109)	
Year Fixed Effects	n	y	y	y	y	
Major Fixed Effects	n	n	y	y	y	
Observations	14,345	14,345	14,345	14,345	14,345	
R-squared	0.084	0.139	0.222	0.251	0.260	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

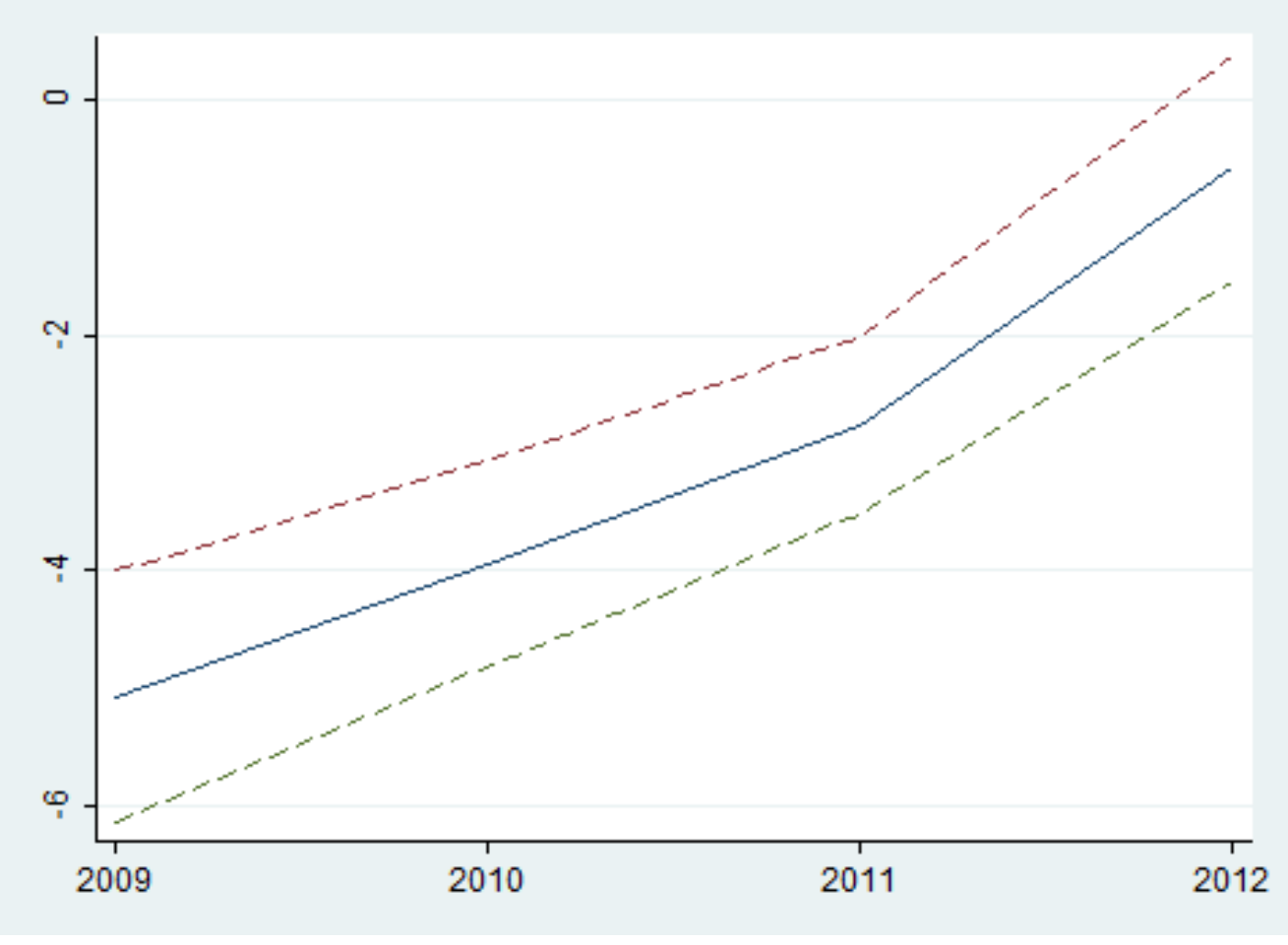
Structural Parameters: Logit Estimation

VARIABLES	(1) OLS	(2) IV	(3) IV	(4) IV	(5) IV	(6) IV
Tuition (in 2008 Reais)[1]	-0.000240*	-0.00949***	-0.0106***	-0.0134***	-0.0121***	-0.0127***
	(0.000128)	(0.00166)	(0.00181)	(0.00247)	(0.00247)	(0.00329)
(Students with FIES loan)x(Tuition)[1]	-8.10e-05	0.0477	0.0668*	0.126***	0.120***	0.119***
	(0.000513)	(0.0333)	(0.0347)	(0.0411)	(0.0349)	(0.0367)
Students with Fies loan to Enrolled Students Ratio [1]	0.548	-3.850	-13.52	-48.90**	-48.19**	-48.68**
	(0.497)	(22.88)	(23.34)	(24.55)	(19.90)	(21.62)
Enrolled Students (Total)[1]	0.000763***				0.000780***	0.000747***
	(0.000126)				(0.000293)	(0.000265)
Applicant Students to Max Class Size (Ratio)[1]	0.101***				-0.785**	-0.750**
	(0.0251)				(0.323)	(0.327)
Faculty Quality[2] *	0.0611					1.067
	(0.253)					(1.336)
Degrees (Total)[2]	-0.000176					-0.00112
	(0.000673)					(0.00342)
Administrative Staff (Total)[2]	0.000383*					0.000241
	(0.000227)					(0.000400)
Faculty (Total)[2]	7.36e-05**					-6.54e-05
	(3.14e-05)					(0.000225)
$((AvgTuition)^3_{-ht})x(HEIQualifiedforFIES(dummy)^2)$	0.000139					
	(0.000230)					
$((AvgTuition)^3_{-ht}) \times (DegreeQualifiedforFIES(dummy)^1)$	-0.000163					
	(0.000163)					
$(MeanWageFaculty^3) \times (HEIQualifiedforFIES(dummy)^2)$	-4.37e-05					
	(6.97e-05)					
$(MeanWageFaculty^3) \times (DegreeQualifiedforFIES(dummy)^1)$	5.78e-05*					
	(3.47e-05)					
$(MeanWageAdmStaff^3) \times (HEIQualifiedforFIES(dummy)^2)$	-5.00e-05					
	(8.01e-05)					
$(MeanWageAdmStaff^3) \times (DegreeQualifiedforFIES(dummy)^1)$	-1.34e-05					
	(4.95e-05)					
Constant	-7.392***	-2.547***	-2.902***			
	(0.355)	(0.804)	(0.886)			
Year Fixed Effects	y	n	y	y	y	y
Major Fixed Effects	y	n	n	y	y	y
Observations	14,345	14,345	14,345	14,345	14,345	14,345
R-squared	0.240	-2.632	-4.232	-13.832	-10.094	-9.774
Number of CO_CURSO	6,828					

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

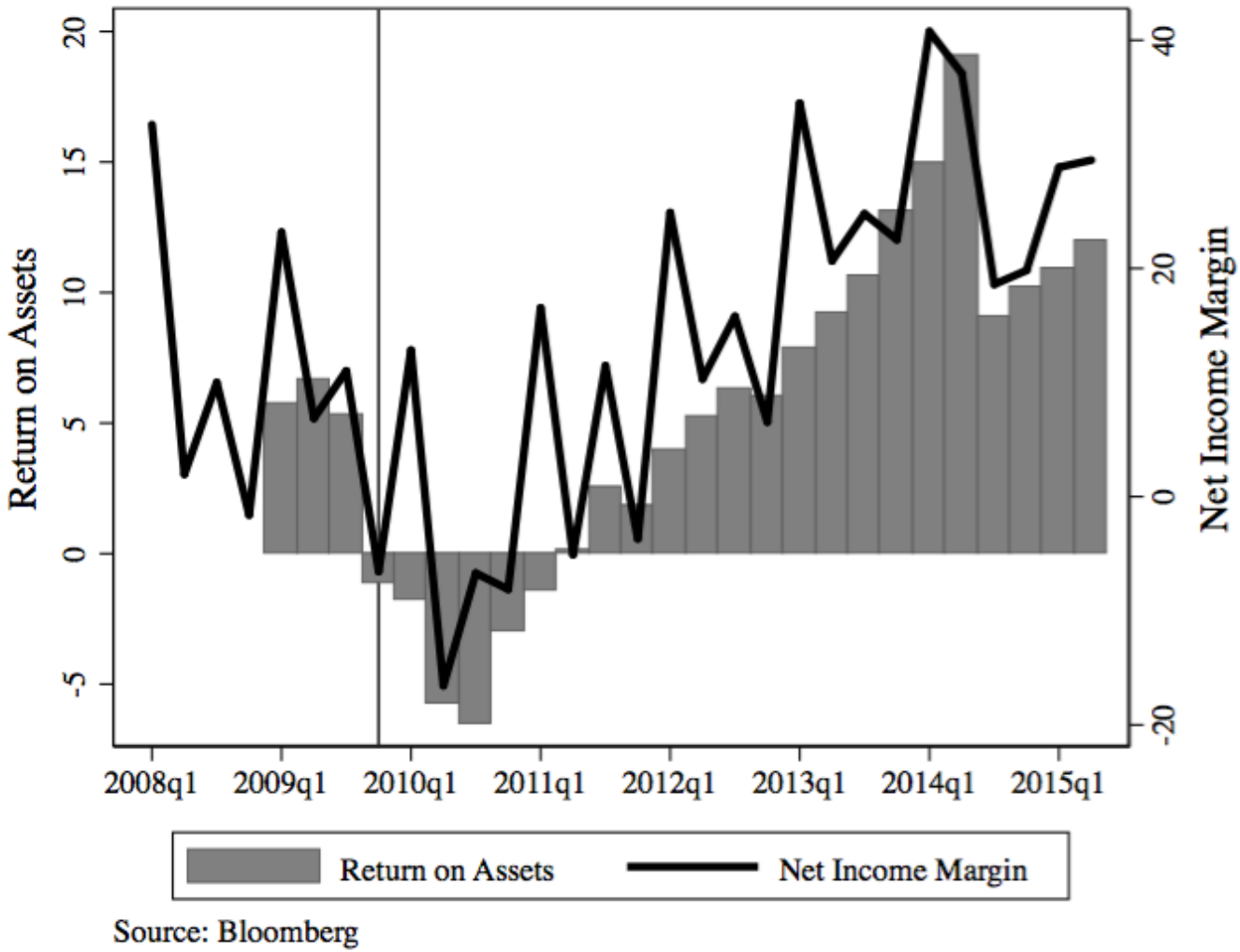
Discussion: How Important is Increased Elasticity?

Figura: Average Elasticity, 2009- 2012



Discussion: How Important is Increased Inelasticity?

Figura: Kroton: Return on Assets and Net Income Margim in Percentage Points



Source: Bloomberg

Discussion: How Important is Increased Inelasticity?

- Figure is compatible with increased scale and reduced elasticity.
- Can we say someting quantitative?

Discussion: How Important is Increased Inelasticity?

- Using:
  - Estimated elascitity (Table 7, column 6)
  - Number of effective firms at the major-city level
  - FIES penetration
  - We can use a simple oligopolistic model to measure the quantittive importance of reduced elasticity

Discussion: How Important is Increased Inelasticity?

- Consider a simple static oligololistic pricing model, such as Cournot (Bresnahan, 1982):

Pricing Under Cournot

$$Margin \equiv \frac{Tuition - MC}{Tuition} = \frac{1}{|\epsilon(FIES)| \times N} \tag{9}$$

Differences in Margins

$$\frac{Margin_{AfterFIES} - Margin_{BeforeFIES}}{Margin_{BeforeFIES}} = \frac{\frac{1}{|\epsilon(FIES_{2012})| \times N_{2009}} - \frac{1}{|\epsilon(FIES_{2009})| \times N_{2009}}}{\frac{1}{|\epsilon(FIES_{2009})| \times N_{2009}}} \tag{10}$$

Discussion: How Important is Increased Inelasticity?

Tabela: Effective Firms and FIES: City Level, 2009 - 2012

Variable	2009	2010	2011	2012
Effective Firms	3.4	3.3	2.6	2.2
Enrolled Students per College	951	1042	1018	1333
% Students with FIES loan	2%	3%	4%	7%

Discussion: How Important is Increased Inelasticity?

- Plugging the numbers from the table above:

Margins 2012 v. 2009

$$\frac{Margin_{FIES2012} - Margin_{FIES2009}}{Margin_{FIES2009}} = 2.09 \tag{11}$$

Conclusion

- Using the large scale FIES experiment, we document three facts.
  - Reduced-form object: tuition increase will the availability of cheap subsidized student loans.
  - Structural object: increased availability of student loans reduce the tuition-elasticity of demand.
  - Reduced elasticity accounts for about 56% of the increase in Net Income Margins for Kroton.