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

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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


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)**
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

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<thead>
<tr>
<th></th>
<th>Before 2010</th>
<th>After 2010</th>
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<tr>
<td>Subscription Period</td>
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<td>Maximum L-t-V</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>Utilization Period</td>
<td>Duration</td>
<td>Duration; max pay R50 per quarter</td>
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<tr>
<td>Grace Period</td>
<td>12 m</td>
<td>18 m; max pay B50 per quarter</td>
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<tr>
<td>Amortization Period</td>
<td>After grad, 2x time financed</td>
<td>After grad, 3x time financed</td>
</tr>
</tbody>
</table>
FIES: the 2010 ramp-up

- Major changes (Universities’ perspective):
  - Lower drop-out rates
  - Universities are paid in Treasury debt instruments redeemable 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 CPC.

  - CPC is a mixture of the score on the ENADE exam and school characteristics 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

\[
\log(Tuition)_{it} = \theta + \varphi D_t \times Treatment_i + \rho X_{it} + \mu_t + \eta_i + \zeta_{it} \tag{1}
\]
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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treated - pre FIES</th>
<th>Control - pre FIES</th>
<th>Mean Diff - pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition (in 2008 Reais) (^1) - Mean</td>
<td>580</td>
<td>515</td>
<td>3.17e-07</td>
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<tr>
<td>Tuition (in 2008 Reais) (^1) - StDev</td>
<td>315</td>
<td>322</td>
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<td>Enrolled Students (Total) (^1) - Mean</td>
<td>459</td>
<td>303</td>
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<td>362</td>
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<td>8</td>
<td>1.13e-07</td>
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<td>34</td>
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<td>% Students with Fies loan (^1) - Mean</td>
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<td>2.2</td>
<td>1.47e-08</td>
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<td>% Students with Fies loan (^1) - StDev</td>
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<td>5.0</td>
<td></td>
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<tr>
<td>Quality Indicator (^1) - Mean</td>
<td>2.6</td>
<td>1.6</td>
<td>0</td>
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<td>Quality Indicator (^1) - StDev</td>
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<td>0.4</td>
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### Descriptive Statistics: Treatment and Control, Only CPC 2 and 3, Pre Treatment

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<th>Control - pre FIES</th>
<th>Mean Diff - pvalue</th>
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Descriptive Statistics: Treatment and Control, Only CPC 2 and 3, Post Treatment

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<td>871</td>
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</table>
Reduced Form: Validity of Assumptions

- Reduced-form: $\zeta_{it}$ contains unobserved demand and supply shifters.
  - Demand side: quality.
  - Supply side: quantities 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.
  - Assessment of quality made every three years.
Reduced Form: Validity of Assumptions

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.
Reduced Form: Results
## Reduced Form: Results, Whole Sample

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) DD</th>
<th>(2) DD</th>
<th>(3) DD</th>
<th>(4) DD</th>
<th>(5) DD</th>
<th>(6) DD</th>
<th>(7) DD</th>
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</thead>
<tbody>
<tr>
<td>Treatment effect - (FIES x Dt)</td>
<td>0.110***</td>
<td>0.072***</td>
<td>0.063***</td>
<td>0.067***</td>
<td>0.063***</td>
<td>0.058***</td>
<td>0.056***</td>
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<tr>
<td></td>
<td>(0.030)</td>
<td>(0.018)</td>
<td>(0.018)</td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.016)</td>
<td>(0.015)</td>
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<td>0.020</td>
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<td>0.096***</td>
<td>0.094***</td>
<td>0.096***</td>
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<td>-0.144**</td>
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<td>-0.0008***</td>
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<td>0.0001***</td>
<td>7.49e-05*</td>
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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

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<th>(3)</th>
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<td>0.100***</td>
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<td>Applicant Students to Max Class Size (Ratio)(^1)</td>
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<td>0.021</td>
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</table>

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

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<td>-1.75e-05</td>
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<td>Applicant Students to Max Class Size (Ratio)</td>
<td>0.0388***</td>
<td>0.0432***</td>
<td>0.0441***</td>
<td>0.0257**</td>
<td>0.105***</td>
<td>0.147***</td>
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<td>0.624***</td>
<td>0.618***</td>
<td>0.632***</td>
<td>0.511**</td>
<td>0.591***</td>
<td>0.625***</td>
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<td>(0.0838)</td>
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<td>-0.00453**</td>
<td>-0.00599**</td>
<td>-0.00121</td>
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<td>-0.0116***</td>
<td>-0.00456**</td>
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<td>(0.000174)</td>
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<td>(0.000351)</td>
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<td>7.333***</td>
<td>7.339***</td>
<td>7.420***</td>
<td>7.355***</td>
<td>7.190***</td>
<td>7.331***</td>
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<td>(0.0800)</td>
<td>(0.105)</td>
<td>(0.0906)</td>
<td>(0.0574)</td>
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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 COJES: 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
Let $t = 1, \ldots T$ be $T$ markets, and $k = 1, \ldots, K$ de $K$ different major-college pairs, and $i = 1, \ldots I$ be $I$ consumers. We define a market as a county-year pair. Student $i$'s indirect utility if she goes to major-college $k$ in market $t$, $U_{ikt}$, is given by

\begin{equation}
U_{ikt} = \delta_{kt} + \epsilon_{ikt}
\end{equation}

\begin{equation}
\delta_{kt} \equiv X_{kt}\beta - \alpha p_{kt} + \omega FIES_{kt} + \lambda FIES_{kt} \ast p_{kt} + \xi_{kt}
\end{equation}
Assumption 1: students choose one major-college pair only. Comment on outside option.

Assumption 2: $\epsilon_{ikt}$ is multinomial logit.

Assumption 3: $\epsilon_{ikt}$ is i.i.d. Comment on Independence of Irrelevant Alternatives.
Given a vector $K \times 1$ 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**

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

**Determination of the market share 2**

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

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

\begin{align*}
\text{Market Shares: i.i.d. Multinomial Logit} \\
\end{align*}

\begin{align*}
  s_{kt} &= \frac{\exp(\delta_{kt})}{1 + \sum_{v=1}^{K} \exp(\delta_{vt})} \\
\end{align*}

- The own-elasticity is given by:

\begin{align*}
\text{Own- Elasticity} \\
\frac{\partial s_{kt} p_{kt}}{\partial p_{kt} s_{kt}} &= (-\alpha + \lambda \ast FIES_{kt}) p_{kt} (1 - s_{kt}) \\
\end{align*}
Taking logs in (4) and subtracting the share of the outside option ($s_{0t}$), we have a regression model:

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

- $\xi_{kt}$ 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 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

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<th>(5)</th>
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<td>Tuition (in 2008 Reais)</td>
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<td>0.0179**</td>
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<td>(0.00847)</td>
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<td>Enrolled Students (Total)¹</td>
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<td>37.12***</td>
<td>(5.235)</td>
<td>(5.216)</td>
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<td>Applicant Students to Max Class Size (Ratio)¹</td>
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<td>Faculty Quality² *</td>
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<td>Degrees (Total)²</td>
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</tr>
<tr>
<td>Administrative Staff (Total)²</td>
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<tr>
<td>Faculty (Total)²</td>
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<td>(Average Tuition)³_h</td>
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<td>0.234**</td>
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<td>-97.16**</td>
<td>-112.0***</td>
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<tr>
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<td>-96.18</td>
<td>-91.64***</td>
<td>-100.5***</td>
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<td>0.214***</td>
<td>0.230***</td>
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<td>0.140</td>
<td>0.162**</td>
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<td>0.150***</td>
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<td>0.069</td>
<td>0.314</td>
<td>0.457</td>
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Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
## First Stage: FIES Penetration

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<td>Students with Fies loan to Enrolled Students Ratio (^1)</td>
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<td>(3.58e-06)</td>
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<td>Applicant Students to Max Class Size (Ratio) (^1)</td>
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<td>0.00407***</td>
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<td>Administrative Staff (Total) (^2)</td>
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<td>(2.93e-05)</td>
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<td>4.94e-07</td>
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<td>(4.15e-06)</td>
<td>(4.15e-06)</td>
<td>(3.90e-06)</td>
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Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
### Structural Parameters: Logit Estimation

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Robust standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1
Discussion: How Important is Increased Elasticity?

**Figure:** Average Elasticity, 2009-2012
Discussion: How Important is Increased Inelasticity?

Figure: Kroton: Return on Assets and Net Income Margin in Percentage Points

![Graph showing return on assets and net income margin over time.](source: Bloomberg)
Discussion: How Important is Increased Inelasticity?

- Figure is compatible with increased scale and reduced elasticity.
- Can we say something quantitative?
Discussion: How Important is Increased Inelasticity?

Using:

- Estimated elasticity (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 quantitative importance of reduced elasticity
Consider a simple static oligopolistic pricing model, such as Cournot (Bresnahan, 1982):

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

\[
\frac{Margin_{AfterFIES} - Margin_{BeforeFIES}}{Margin_{BeforeFIES}} = \frac{\frac{1}{|\epsilon(FIES_{2012})| \times N_{2009}} - \frac{1}{|\epsilon(FIES_{2009})| \times N_{2009}}}{\frac{1}{|\epsilon(FIES_{2009})| \times N_{2009}}} \tag{10}
\]
**Discussion: How Important is Increased Inelasticity?**

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<th>2012</th>
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<td>2%</td>
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<td>4%</td>
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Discussion: How Important is Increased Inelasticity?

Plugging the numbers from the table above:

\[
\frac{\text{Margin}_{\text{FIES}2012} - \text{Margin}_{\text{FIES}2009}}{\text{Margin}_{\text{FIES}2009}} = 2.09
\] (11)
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.