Bank Capital Requirements and Loan Pricing: Loan-level Evidence from a Macro Prudential Within-Sector Policy

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The views expressed in this work are those of the author(s) and do not necessarily reflect those of the Banco Central do Brasil or its members.
Introduction

- International financial crisis of 2007/2008 ⇒ financial regulation with a new macro prudential dimension
  - Countercyclical capital requirements
    - Example: Basel III countercyclical buffer.
  - Sectoral capital requirements
    - The policy of varying capital requirements only on lending to sectors that may be exhibiting particular exuberance (CGFS, 2012; BoE, 2014)
  - Within-sector capital requirements (Brazil, circulars 3515, 3563)
    - Capital requirements raised, and later released, only for particular targets within the sector
The Brazilian auto loan credit sector in 2009-2010: too fast and unbalanced expansion?

Credit to new auto loans (R$ bill)

New auto loans by maturity (share - %)

New auto loans by LTV (share - %)

Loan Spread (monthly average - %)
Central Bank of Brazil adopted a macro-prudential approach

Capital requirement doubled, from 8.25% to 16.5%, for new auto loans with long maturities and high LTVs:

New regulation established on December, 3th of 2010

<table>
<thead>
<tr>
<th>Maturity (months)</th>
<th>&gt;24</th>
<th>&gt;36</th>
<th>&gt;48</th>
<th>&gt;60</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTV(%)</td>
<td>&gt;80</td>
<td>&gt;70</td>
<td>&gt;60</td>
<td>All</td>
</tr>
</tbody>
</table>

Table: universe of auto loans targeted by new regulation
What happened afterwards?

Credit to new auto loans (R$ bill)

New auto loans by LTV (share - %)

New auto loans by maturity (share - %)

Loan Spread (monthly average - %)
The spread behavior of targeted and untargeted auto loans

- Banks passing to targeted loans their higher total financing costs derived from the higher capital requirements?
Transmission mechanism from higher capital requirements to higher banks’ loan spreads:

- Higher capital requirement increases optimal internal target for bank capital ratio (e.g. Berrospide and Edge, 2009; Francis and Osborne, 2012; Hancock and Wilcox, 1993 and 1994).
- Higher (future) capital increases bank total financing costs, (e.g. Admati, 2011; Freixas and Rochet, 2008), then passed to lending spreads.
  - The intensity of this effect is a matter of large debate (e.g. BCBS, 2010; Hanson *et al.*, 2010; MAG, 2010; Miles *et al.*, 2013).
- This paper provides new evidence of material effects.
  - Our results are new: previous studies gauge the consequences on spreads of increases in actual capital.
To examine the consequences on auto loan spreads of the novel macro prudential within-sector capital measure

- If banks consider in their pricing the cost of allocated regulatory capital, then they will increase the spreads mainly of targeted auto loans.
  - Previous graphical analysis suggests this is the case.

Remark: the set of untargeted auto loans may be affected by spillovers

- Some pass-through of the higher bank total financing costs also to untargeted loans
- Migration of demand from targeted to untargeted loans (substitution effect)
The identification strategy

- Disentangle credit supply behavior from demand effects by means of a regulatory capital shock.
  - Aiyar et al. (2014), Berger and Udell (1994), Brinkmann and Horvitz (1995) and Jimenez et al. (2013)

- To further control for demand effects: loan-level data and fixed effects (Jimenez et al., 2012 and 2013 and our paper)

- Differently to most of this literature, our focus is on prices rather than quantities.
  - Average new auto loan size slightly changed following the new regulation while number of new auto loans sharply declined.
Model for the impact of new regulation:

$$\text{Loan\_spread}_{i,b,l,t} = c + \gamma \cdot \text{Targeted loan}_l + \alpha \cdot \text{New regulation}_t + \beta \cdot \text{New regulation}_t \times \text{Targeted loan}_l + \text{bank controls}_{b,t-1} + \text{loan controls}_l + \text{time controls}_t + \text{fixed effect}_{i,b} + \text{error term}_{i,b,l,t}$$

- $\beta$ measures the relative impact of the regulatory capital increase on the spread charged on targeted auto loans in comparison to untargeted ones
  - We expect $\beta > 0$

- $\alpha$ represents the spread increase suffered by untargeted auto loans after the new regulation
  - Spillovers to the set of untargeted loans would be consistent with $\alpha > 0$
Loan controls: *amount*, *maturity* and *LTV*
- Possibly jointly determined with loan spreads
- Models estimated both with and without loan controls

Variable *Loan targeted* also possibly jointly determined with loan spreads
- At the core of the analysis
- Matched loan approach: no migration
  - Robustness: matched loans sufficiently close.
Methodology

- On November 11th, 2011, regulation changed again, abolishing most of the previous capital increases for auto loans.

- Model for the impact of the regulatory capital release:

\[
\text{Loan}\_\text{spread}_{i,b,l,t} = c + \gamma \cdot \text{targeted loan}_l + \alpha \cdot \text{regulatory release}_t + \beta \cdot \text{regulatory release}_t \times \text{targeted loan}_l + \text{bank controls}_{b,t-1} + \text{loan controls}_l + \text{time controls}_t + \text{fixed effect}_{i,b} + \text{error term}_{i,b,l,t}.
\]

- We expect $\beta < 0$

- Comparison of $\beta$'s
Data

- Sample: new auto loans granted from June 2010 to May 2011 (new regulation models) or from July 2011 to March 2012 (regulatory release models).

- Data sources: SCR (Brazilian Public Credit Register) and COSIF (accounting database of Brazilian financial institutions)
## Results: introduction of new regulation

<table>
<thead>
<tr>
<th>Dependent variable: Loan_spread</th>
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<th>(2)</th>
<th>(3)</th>
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<th>(5)</th>
<th>(6)</th>
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</thead>
<tbody>
<tr>
<td>New regulation ($\alpha$)</td>
<td>0.29</td>
<td>0.38***</td>
<td>0.78***</td>
<td>0.27</td>
<td>0.15</td>
<td>0.11</td>
</tr>
<tr>
<td>New regulation x Targeted loan ($\beta$)</td>
<td>3.52***</td>
<td>2.87***</td>
<td>2.33***</td>
<td>2.39***</td>
<td>2.33***</td>
<td>2.19***</td>
</tr>
</tbody>
</table>

| Loan controls                   | Yes   | Yes   | Yes   | Yes   | Yes   | Yes   |
| Fixed effects                   | No    | borrow er | borrow er-bank | borrow er-bank | borrow er-bank | borrow er-bank |
| Before and after new regulation | No    | No    | No    | Yes   | Yes   | Yes   |
| Matched by loan type (no migration) | No    | No    | No    | No    | Yes   | Yes   |
| Short distance between matched loans | No    | No    | No    | No    | No    | Yes   |

| Number of observations | 2,746,173 | 200,860 | 70,017 | 37,020 | 23,305 | 9,097 |
| $R^2$ (adj)            | 0.58    | 0.50   | 0.30   | 0.33   | 0.37   | 0.34  |
• Model (1) does not control for any unobservable borrower characteristic ⇒ estimates based on the full set of auto loan borrowers
  • β equal to 3.52p.p.; α insignificant

• Model (2) has β = 2.87p.p. and borrower fixed effects, whereas model (3) has borrower-bank fixed effects and β = 2.33p.p.

• Model (4): only borrowers who have taken out loans from the same bank both before and after the new regulation
• Model (5): within each borrower-bank, only auto loans with no migration
• Model (6): matched loans at most 90 days apart
  • Models (4)-(6): magnitude of β close to that of model (3), α again insignificant; increasingly smaller samples but adj-R² higher than in model (3)

• Smallest estimated β: the spread charged on the same borrower by the same bank for targeted auto loans increased 2.19 p.p. after the new regulation
  • This figure represents an increase of 0.26 p.p. in spreads for an additional capital requirement of 1%.
Potential endogeneity of loan controls ⇒ same previous models estimated without them

Coefficient $\beta$ remains always positive, significant and with magnitudes not distant from the respective previous models.

Except for model (3), coefficient $\alpha$ never significant.

Combined evidence does not allow conclusion that the spread of untargeted loans has also increased due to the introduction of new regulation
  - Substitution effects related to the migration of demand have been limited.
  - Pass-through of higher bank total financing costs to the set of untargeted loans has also been limited.
### Results: introduction of new regulation

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<tr>
<td>New regulation ($\alpha$)</td>
<td>-0.17</td>
<td>0.14</td>
<td>0.70***</td>
<td>0.03</td>
<td>-0.10</td>
<td>-0.17</td>
</tr>
<tr>
<td>New regulation x Targeted loan ($\beta$)</td>
<td>3.94***</td>
<td>3.09***</td>
<td>2.20***</td>
<td>2.14***</td>
<td>2.05***</td>
<td>2.12***</td>
</tr>
<tr>
<td>Loan controls</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fixed effects</td>
<td>No</td>
<td>borrower</td>
<td>borrower</td>
<td>borrower</td>
<td>borrower</td>
<td>borrower</td>
</tr>
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<td>Before and after new regulation</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Matched by loan type (no migration)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Short distance between matched loans</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
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<td>$R^2$ (adj)</td>
<td>0.22</td>
<td>0.25</td>
<td>0.11</td>
<td>0.16</td>
<td>0.19</td>
<td>0.17</td>
</tr>
</tbody>
</table>
Bank cross-section analysis

• Estimated increases on loan spreads really driven by higher bank financing costs?

• Banks are ordered according to their expected accounting-based $\Delta$spreads
  • Expected $\Delta$spreads take into account the rise in bank financing costs by means of a simple accounting approach (e.g. BCBS 2010; Elliot, 2009)
    • Assumptions: capital ratio, ROE and total assets constant

• $\beta$’s estimated for each bank separately.

• Results for the three largest banks in our sample (>3/4 of the number of loans)
## Results by bank

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</tr>
</thead>
</table>
| **New regulation \( t \times \text{Targeted loan (}\beta\)***
| Bank 1 (low \( \Delta \text{spread} \)) | 3.01*** | 1.51*** | 1.52*** | 1.56*** | 1.50*** | 1.40*** |
| Bank 2 (medium \( \Delta \text{spread} \)) | 4.57*** | 2.81*** | 2.86*** | 2.86*** | 2.84*** | 2.20*** |
| Bank 3 (high \( \Delta \text{spread} \)) | 4.33*** | 4.29*** | 4.13*** | 4.43*** | 4.70*** | 5.07*** |
| **Loan controls**                  | Yes | Yes | Yes | Yes | Yes | Yes |
| **Fixed effects**                  | No  | borrower | borrower-bank | borrower-bank | borrower-bank | borrower-bank |
| **Before and after new regulation** | No  | No  | No  | Yes | Yes | Yes |
| **Matched by loan type (no migration)** | No  | No  | No  | No  | Yes | Yes |
| **Short distance between matched loans** | No  | No  | No  | No  | No  | Yes |
## Results: regulatory capital release

<table>
<thead>
<tr>
<th>Dependent variable: Loan_spread</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory release ($\alpha$)</td>
<td>0.06</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.31</td>
<td>0.55</td>
<td>0.45</td>
</tr>
<tr>
<td>Regulatory release x Targeted loan ($\beta$)</td>
<td>-0.42</td>
<td>-0.09</td>
<td>-0.46***</td>
<td>-0.72***</td>
<td>-0.82***</td>
<td>-0.65***</td>
</tr>
</tbody>
</table>

| Loan controls                | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fixed effects                | No  | borrower | borrower-bank | borrower-bank | borrower-bank | borrower-bank |
| Before and after regulatory release | No  | No  | No  | Yes | Yes | Yes | Yes |
| Matched by loan type (no migration) | No  | No  | No  | No  | Yes | Yes | Yes |
| Short distance between matched loans | No  | No  | No  | No  | No  | No  | Yes |

| Number of observations | 2,660,465 | 178,170 | 50,120 | 26,380 | 16,505 | 10,828 |
| $R^2$ (adj)             | 0.53  | 0.47  | 0.32  | 0.32  | 0.31  | 0.31  |
• Coefficient of the interaction ($\beta$) negative and significant at 1%, except for models (1) and (2)
  • Banks charged relatively smaller spreads after the regulatory release on their auto loans whose capital requirements decreased.

• Absolute magnitudes much smaller than corresponding magnitudes in the models for the introduction of new regulation.
  • The cancelation of the capital requirement increase had a smaller impact on spreads than original capital increase.
  • Possible explanation: more precautionary behavior adopted by banks
• Capital requirements raised and later released in Brazil for auto-loans with specific long maturities and high LTVs. (Within-sector capital requirements)

• Brazilian banks raised, after the new regulation, spreads charged on the same borrower for auto loans whose capital requirements increased.
  • Rise was at least 2.19 p.p. for a 8.25% additional capital requirement.
  • In the universe of the largest banks, the spread rise was higher the larger the increase of bank financing costs.

• Evidence on increase of spreads charged for the set of untargeted auto loans not robust.
  • Spillovers were limited

• Release of regulatory capital similarly associated to lower spreads
  • However, reduction in spreads smaller than the original rise
Thank you for your attention!

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