Measuring Financial Restrictions of Brazilian Private Firms with Microdata: Did Credit Policies of Banco Central do Brasil During the Covid-19 Pandemic Affect Investment Demand?

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Agenda

- Objectives
- Financial Restrictions of Firms
- Contributions
- Data
- Empirical Strategy
- Results
- Conclusion
Disclaimer

• The views expressed in this presentation work are those of the author and do not necessarily reflect those of the Banco Central do Brasil or its members
Objectives

- We have three objectives
  - Build measures of Financial Restrictions (hereafter FRs) of Brazilian private firms using microdata
    - FRs with good attributes
  - Use these measures to estimate investment cash-flow sensitivities
    - Estimate Investment Demand Functions
  - Verify if credit policies of Banco Central do Brasil in the covid-19 pandemic (2020) had a positive impact on FRs and investment of firms
Definition of FR

- FR is difficult to define
- A common definition, however, in the literature and one that we will use in this paper is:
  - Firm is FR if it has a positive Present Value Investment (project) \((PV>0)\), asks for banks loans to take on this investment (project) and the banks deny giving the credit
Measuring FR

➢ Previous definition
  ➢ For one to observe FR in practice
    ➢ One would have to ask the firm if it has a PV >0
    ➢ Then knock on the doors of the banks and ask if they have denied the credit to the firm for this specific purpose
  ➢ Of course very difficult (impossible?!)
  ➢ So this makes, in empirical terms, FR non-observable
    ➢ Therefore, very hard to measure or estimate
Properties of a Good Measure of FR

- Silva and Carreira (2012)
  - Simple
  - Objective
  - Firm specific
  - Continuous
  - Time varying
Measuring FR

- Indirect, Direct Measures and Indexes
- Indirect Measures
  - Sensitivity of Investment in relation to Cash-Flow
  - FR present: sensitivity is higher
- Ex-ante classification of firms based on balance sheet characteristics
- Tobin´s marginal q or Tobins´ average Q
  - Measures growth opportunities (or investment) of firms
Pitfalls of Indirect Measures

- Problems associated with Q of Tobin measurements and therefore investment opportunities
  - Impossible to measure marginal q correctly, which Theory shows is the correct one
  - Average Q may be a bad proxy for marginal q
  - No average Q for private firms
Pitfalls of Indirect Measures

- Cash-Flow may contain information about investment opportunities
  - Firms highly uncertain about investment projects
- Clearly et al. (2007)
  - Relation between cash-flow and investment non-monotonic
Direct Measures of FR

- Reports of Public Firms
  - End of the year financial statements
  - Off-balance sheet information
- Surveys
FR Direct Measures

- Firm specific
- Eventually time varying
- One can use FR in this case as a dependent or independent variable in regressions
Direct Measures

- Company reports
  - Kaplan and Zingales (1997)
  - Keywords, expressions that are symptomatic of the presence of financial constraints
  - Use quantitative information as well
FR Survey Information

- Main advantage is the fact that firms are the best informed agents with respect to the quality of their projects or investments.
- One should expect investment opportunities are already taken into account in firms' responses.
- One can measure FR for small and young firms, which is an advantage over company reports.
Pitfalls of Surveys

- Subjective nature of responses may lead to wrong understanding of the capacity firms have to obtain credit for investment
  - Researcher has to use quantitative information as well
- Information is expensive to collect, rather scarce and with insufficient level of detail
- Information coming from Financial Institutions to complement information of firms are not available
Measures of FR

- Indexes
  - Combination of indirect and direct measures
    - Kaplan and Zingales (1997)
    - Whited and Wu (WW) (2006)
  - They have the advantages and disadvantages of direct and indirect measures
Contributions of our Paper

- We use microdata to define FR, which is rare in the literature
  - We use loan contracts of Credit Information System of BCB (SCR)
    - We have the type of loan among many other information
  - We observe firms that are very likely not to be financially constrained
    - Obtained loans for investment or project financing
  - We observe others that are very much unlikely to obtain loans for investment
    - Are in restructuring or liquidation
- We look at private firms, which is also not common in the literature
  - Most papers look only at public firms
    - That by definition should be much less likely to be credit constrained than private firms
Contributions of our Paper

- Given our FRs measures, we may understand better investment cash flow elasticities in Brazil
- Credit policies of BCB
- Covid-19 pandemic (2020)
- We think that we can contribute not only to the empirical literature but also in terms of policy
- More information on the difficulties of credit access for firms in Brazil
Credit Policies to SME of BCB due to the Pandemic

- Working Capital Program to preserve business continuity (CGPE)
- Purchase of private securities by BCB in the secondary market
- Deduction on reserve requirement on savings deposits conditional on credit provision to micro and small companies
- Real estate may be used as collateral in more than one credit operation
- Emergency program provides payroll financing to SME in order to preserve employment in the segment
- Fostering credit for small and medium-sized enterprises
- Relaxed provisioning rules for refinancing loans of SME for six months
Sources of Data

- Loan Contracts
  - SCR
  - Around 3.5 million loan contracts
- Firms
  - 8,071 private firms
  - Database of Valorpro: unbalanced panel
  - Balance Sheet Information
  - Mostly joint stock private firms
- SME
- Sample Period 2012 to 2020
## Sample of Firms

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Joint Stock</th>
<th>Limited Liability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>179</td>
<td>16</td>
<td>195</td>
</tr>
<tr>
<td>Commerce</td>
<td>573</td>
<td>217</td>
<td>790</td>
</tr>
<tr>
<td>Energy</td>
<td>778</td>
<td>218</td>
<td>996</td>
</tr>
<tr>
<td>Industry</td>
<td>1,358</td>
<td>621</td>
<td>1,979</td>
</tr>
<tr>
<td>Services</td>
<td>2,615</td>
<td>1,496</td>
<td>4,111</td>
</tr>
<tr>
<td>Total</td>
<td>5,503</td>
<td>2,568</td>
<td>8,071</td>
</tr>
</tbody>
</table>
Number of Loan Contracts
Empirical Strategy

- Definition of measures FR
- Use information of type of loan contracts and firm credit status
  - Investment
  - Financing
  - “Working Capital”
    - All sorts of loans that are not financing or investment
  - Firm is in a restructurining process or in liquidation
Empirical Strategy

- Classify firms in 5 categories
- 5 = Very likely to be non financially restricted
- 4 = Likely to be non financially restricted
- 3 = Not enough information to classify
- 2 = Likely to be financially restricted
- 1 = Very likely to be financially restricted
Empirical Strategy

- We use Whited and Wu (WW) index (2006) and estimate ordered probit panel models with our ex-ante financial restrictions classifications as dependent variables
  - WW uses: Cash-Flow, long term debt/assets, log(assets), sales growth
  - WW does not use Q of Tobin!
Empirical Strategy

- From these regressions, we find the threshold values of probabilities of each category.
- We select our preferred index based on higher average probabilities of predicting categories 1, 2, 4 and 5.
Empirical Strategy

- Consider FR
  - Firms in categories 1 or 2
- Consider NFR
  - Firms in categories 4 and 5
- Separate our sample in FR and non FR and estimate investment demand functions of firms
  - Controlling for the covid-19 pandemic
  - BCB credit policies
# Definition Main FRs

<table>
<thead>
<tr>
<th>FR1(2)[3]</th>
<th>Categories</th>
<th>Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Likely Financial Restricted</td>
<td>Information on Reestructuring or Liquidation</td>
</tr>
<tr>
<td>5</td>
<td>Very Unlikely to be Financially Restricted</td>
<td>Investment or Project Financing</td>
</tr>
<tr>
<td>2</td>
<td>Likely to be Financially Restricted</td>
<td>Only &quot;Working Capital&quot; and Average Interest Rate $&gt;70%(80%)[90%]$ percentil and average maturity lower than $30%(20%)[10%]$ percentil</td>
</tr>
<tr>
<td>4</td>
<td>Unlikely to be Financially Restricted</td>
<td>Financing and Average Interest Rate $&lt;30%(20%)[10%]$ percentil and average maturity higher than $70%(80%)[90%]$ percentil</td>
</tr>
<tr>
<td>3</td>
<td>Not Clear</td>
<td>No sufficient information to classify</td>
</tr>
</tbody>
</table>
Other Definitions of FR

- We also construct other definitions to classify firms that we are not able to classify in FR or NFR with previous measures (category 3)
  - Information on the number of bank relationships
  - Information on 90 days delinquency of loans
  - Information on demand of financial derivatives
  - Information on the proportion of bad loans of portfolio of loans
  - Balance sheet information
    - Total assets, ebitda, fixed assets
Types of Loan Contracts

- Working Capital Loans
- Financing
- Investment/Project
## Chosen FRs based on WW

<table>
<thead>
<tr>
<th>FR</th>
<th>Average Prob (FR=1 or 2 or 4 or 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fr3_contracts_qifs</td>
<td>0.43</td>
</tr>
<tr>
<td>Fr2_contracts_qifs</td>
<td>0.39</td>
</tr>
<tr>
<td>Fr1_contracts_qifs</td>
<td>0.38</td>
</tr>
</tbody>
</table>
Number of Firms and FR/NFR Measures
Number of Firms FRs and NFRs
Number of Firms FRs and Sectors

- Agriculture
- Commerce
- Energy
- Industry
- Services

The graph shows the number of firms FRs and sectors from 2012 to 2020. The sectors are represented with different colored lines:
- Agriculture
- Commerce
- Energy
- Industry
- Services

The green line, representing Services, shows a trend of decreasing numbers from 2012 to 2020. The other lines show variations in the numbers for each sector over the years.
Number of Firms NFRs

Year


Firms NFRs

0 200 400 600 800 1000 1200 1400

Agriculture  Commerce  Energy  Industry  Services
Average FR and NFR

Financially Restricted
Non Financially Restricted
### Gala and Gomes (2016)

<table>
<thead>
<tr>
<th>Variable</th>
<th>FR</th>
<th>NFR</th>
<th>FR</th>
<th>NFR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>var_oper_rev</strong></td>
<td>0.0048***</td>
<td>-0.211***</td>
<td>0.0200***</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(3.4994)</td>
<td>(-13.46)</td>
<td>(3.4662)</td>
<td>(-0.604)</td>
</tr>
<tr>
<td><strong>pandemic*var_oper_rev</strong></td>
<td>-0.000767</td>
<td>-0.00027</td>
<td>-0.06603***</td>
<td>-0.02869**</td>
</tr>
<tr>
<td></td>
<td>(-0.043)</td>
<td>(-0.230)</td>
<td>(-2.915)</td>
<td>(-2.366)</td>
</tr>
<tr>
<td><strong>pandemic</strong></td>
<td>-0.06603***</td>
<td>-0.02869**</td>
<td>-0.06603***</td>
<td>-0.02869**</td>
</tr>
<tr>
<td></td>
<td>(-2.915)</td>
<td>(-2.366)</td>
<td>(-2.915)</td>
<td>(-2.366)</td>
</tr>
<tr>
<td><strong>pandemic*var_oper_rev+var_oper_rev</strong></td>
<td>0.0019</td>
<td>-0.0009</td>
<td>0.0019</td>
<td>-0.0009</td>
</tr>
<tr>
<td></td>
<td>(1.1659)</td>
<td>(-1.48)</td>
<td>(1.1659)</td>
<td>(-1.48)</td>
</tr>
</tbody>
</table>

| Robust Covariance               | yes            | yes            | yes            | yes            |
| Firm Fixed Effects              | yes            | yes            | yes            | yes            |
| Dif_Dif                         | no             | no             | yes            | yes            |
| Other Controls                  | yes            | yes            | yes            | yes            |
| N                               | 213            | 1435           | 52             | 407            |
VEC Model Bond et al. (2003)

<table>
<thead>
<tr>
<th></th>
<th>FR</th>
<th>NFR</th>
<th>FR</th>
<th>NFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>var_oper_rev</td>
<td>0.0003**</td>
<td>-0.217***</td>
<td>0.0162***</td>
<td>-0.00001</td>
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<tr>
<td></td>
<td>(2.2575)</td>
<td>(-15.01)</td>
<td>(3.5393)</td>
<td>(-0.334)</td>
</tr>
<tr>
<td>pandemic*var_rec</td>
<td>0.0240</td>
<td>-0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.1936)</td>
<td>(-0.482)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pandemic</td>
<td>-0.057***</td>
<td>-0.029**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-2.886)</td>
<td>(-2.442)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pandemic*var_rec+var_rec</td>
<td>0.040</td>
<td>-0.029</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.006)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Robust Covariance     yes yes yes yes
Arellano-Bond          yes yes yes yes
Firm Fixed Effects     yes yes yes yes
Other Controls         yes yes yes yes
N                      213 1435 52 407
Lagged Investment Eberly (2012)

<table>
<thead>
<tr>
<th>capex_assets</th>
<th>FR</th>
<th>NFR</th>
<th>FR</th>
<th>NFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>var Oper Rev</td>
<td>0.0002**</td>
<td>0.2316</td>
<td>0.004</td>
<td>-6.294</td>
</tr>
<tr>
<td></td>
<td>(1.9945)</td>
<td>(0.0916)</td>
<td>(0.0022)</td>
<td>(-0.461)</td>
</tr>
<tr>
<td>Pandemic</td>
<td>0.0044</td>
<td>-0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0027)</td>
<td>(-0.608)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pandemic*var Oper Rev</td>
<td>0.0053</td>
<td>-0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0144)</td>
<td>(-0.608)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pandemic*var Oper Rev+var Oper Rev</td>
<td>0.0453</td>
<td>-6.294</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(-0.006)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Robust Covariance: yes, yes, yes, yes
Arellano-Bond: yes, yes, no, no
Firm Fixed Effects: yes, yes, yes, yes
Other Controls Lagged Investment: yes, yes, yes, yes
N: 1363, 204, 195, 36
## Average Treatment Effects (ATE)

<table>
<thead>
<tr>
<th></th>
<th>ATE Capex/Assets</th>
<th>(FR=1-FR=0)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FR=1-FR=0</td>
<td>(FR=1-FR=0)</td>
</tr>
<tr>
<td>Nearest Neighbour Matching</td>
<td>-0.13**</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>(-2.03)</td>
<td>(1.02)</td>
</tr>
<tr>
<td>Propensity Matching Score</td>
<td>-0.0093**</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(-1.98)</td>
<td>(1.12)</td>
</tr>
<tr>
<td>Pandemic</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Conclusion

• Our paper constructs original measures of financial restriction of Brazilian private firms
  – We use loan information of these private firms
• We use these measure to study investment demand of these firms from 2012 to 2020
  – In particular during the pandemic period in 2020, when Banco Central do Brasil implemented several credit policies
Conclusion

• We think our financial restrictions measures to a very good job in explaining the demand of credit for investment of our sample of firms in our sample period
  – FR firms=> dependent on cash-flow
  – NFR firms=> not dependent on cash-flow
  – In particular, our results indicate that credit policies of Banco Central do Brasil had no direct effect on the investment of these firms during the pandemic in 2020
Thank You!