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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CEMLA Joint Research Program 2021
July 28th, 2021
Agenda

➢ Objectives
➢ Financial Restrictions of Firms
➢ Expected Contributions
➢ Data
➢ Empirical Strategy
➢ Preliminary 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 (BCB) 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 ask the banks 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
FR Indirect Measures

- Fazari, Hubbard and Petersen (FHP) (1998)
  - Dividend as a way of classifying FR
- Kaplan and Zingales (1997)
  - Question FHP
  - Quantitative and qualitative information
  - Various categories of FR
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 Data

➢ Survey data

➢ Savignac (2009), Beck et al. (2008), Survey on the access to finance of enterprises (SAFE) ECB, Eurostat “Access to Finance”, among many others

➢ Ask firms whether they are financially restricted or not

➢ Single question or combination of different questions: cost of external funds, credit denials, availability of external funds, etc
FR Survey Information

- Main advantage is the fact that firms are the best informed agents with respect with 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
Expected 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
Expected Contributions

- 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 more (less) 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 1.3 million loan contracts

- Firms
  - Database of Valorpro: unbalanced panel
  - Balance Sheet Information
  - Mostly joint stock private firms
    - SME

- Sample Period 2010 to 2020
## Sample of Firms

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>121</td>
</tr>
<tr>
<td>Commerce</td>
<td>500</td>
</tr>
<tr>
<td>Energy</td>
<td>851</td>
</tr>
<tr>
<td>Industry</td>
<td>1,084</td>
</tr>
<tr>
<td>Services</td>
<td>3,108</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,664</strong></td>
</tr>
</tbody>
</table>
Number of Loan Contracts

- 2020: 0
- 2019: 50000
- 2018: 100000
- 2017: 150000
- 2016: 200000
- 2015: 250000
- 2014: 300000
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 and sector 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>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>3</td>
<td>Not Clear</td>
<td>No sufficient information to classify</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>5</td>
<td>Very Unlikely to be Financially Restricted</td>
<td>Investment or Project Financing</td>
</tr>
</tbody>
</table>
Other Definitions of FR

We also construct other definitions that include the following in the previous definitions:

- Information on 90 days delinquency of loans
- Information on demand financial derivatives
- Information on the proportion of bad loans of portfolio of loans
- Balance sheet information
  - Total assets, coverage ratio, fixed assets
Types of Loan Contracts

![Graph showing different types of loan contracts over years]

- Working Capital Loans
- Financing
- Investment/Project

Years: 2010-2020
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>Fr1_contracts</td>
<td>0.61</td>
</tr>
<tr>
<td>Fr1_contracts_balance</td>
<td>0.52</td>
</tr>
<tr>
<td>Fr1_contracts_derivatives</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Number of Firms FRs and NFRs

Financially Restricted (FR1 or FR2)  Non Financially Restricted (FR4 or FR5)
Number of FRs and Sectors

Agriculture
Commerce
Energy
Industry
Services
Levels of Financial Restrictions

![Graph showing the levels of financial restrictions from 2010 to 2020. The graph compares different financial restriction levels (FR1 to FR5) over the years. Each level shows a distinct pattern of increase and decrease over the years.]
Average FR and NFR

Financially Restricted vs. Non Financially Restricted
Regressions: Adapting Fazarri et al. (1988)

\[ capex_{it} = \beta_0 + \beta_1 \text{var}_{oper, rev_{i(t+1)}} + \beta_2 CF_{it} + \beta_3 CF_{it} \times \text{Pandemic} + a_i + \nu_t + \gamma \text{sectors}_{it} + \epsilon_{it}, \ t=2010\ \text{to}\ 2020, \ i=1\ \text{to}\ 5,664 \]

Q of Tobin substition by first difference of operational revenue next period
Adapting Fazarri et al. (1988)

<table>
<thead>
<tr>
<th></th>
<th>capex_assets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FR</td>
</tr>
<tr>
<td>var_rec_oper</td>
<td>0.075***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
</tr>
<tr>
<td>Ebitdat/Assets</td>
<td>26.08</td>
</tr>
<tr>
<td></td>
<td>(0.41)</td>
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<tr>
<td>(Ebitdat/Assets)*pandemic</td>
<td>1.41*E-9**</td>
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<tr>
<td></td>
<td>(0.03)</td>
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<tr>
<td>Robust Covariance (cluster sectors)</td>
<td>yes</td>
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<tr>
<td>Sectors</td>
<td>yes</td>
</tr>
<tr>
<td>Random Effects</td>
<td>yes</td>
</tr>
<tr>
<td>Obs</td>
<td>509</td>
</tr>
</tbody>
</table>
Regressions: VEC Model

capex_{it} = \beta_0 + \beta_1 capex_{i(t-1)} + \beta_2 CF_{it} + \beta_3 CF_{it} \times \text{Pandemic} + \beta_4 \Delta sales_{i(t-1)} + \\
+ \beta_5 (sales_{i(t-2)} - K_{i(t-2)}) + a_i + \nu_t + \\
\gamma sectors_{it} + u_{it} \\
t=2010 \text{ to } 2020, \ i=1 \text{ to } 5,604 \\
Vector Error Correction Specification \\
Bond et al. (2003), Bond and Lombardi (2006), Bloom et al. (2007)
## VEC Model

<table>
<thead>
<tr>
<th></th>
<th>capex_assets</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FR</td>
<td>NFR</td>
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<tr>
<td>var_sales</td>
<td>42.08***</td>
<td>46.91***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Ebitdat/Assetst-1</td>
<td>3019.1</td>
<td>-3623.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.89)</td>
<td></td>
</tr>
<tr>
<td>(Ebitdat/Assetst-1)*pandemic</td>
<td>1.44*10-7</td>
<td>2.31*10-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.97)</td>
<td>(0.89)</td>
<td></td>
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<tr>
<td>Robust Covariance (cluster sectors)</td>
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<td>yes</td>
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</tr>
<tr>
<td>Sectors</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Random Effects</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Obs</td>
<td>299</td>
<td>1469</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

- Work in progress
  - There is still a lot of work ahead
- Defining FR on monthly basis
- At the moment, collecting more data on balance sheet and loan contracts of other private firms
  - Around 3000 more firms than the sample we show in this presentation
Conclusion

- Estimation of ordered probit models with measurement errors in dependent variable
- Instead of working with ordered regressions
  - Work with binary regressions
- Other measures of FR
  - Number of financial institutions that transact with firms (sometimes used in the literature)
- Estimate other demand functions controlling for Covid-19
Thank You!