Constrained, or not constrained?

Identifying credit constrained firms in the Brazilian economy

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Motivation

- Credit constraints are born from **asymetrical information** between banks and borrowers (Stiglitz and Weiss 1981)
- Financially constrained firms have lower levels of:
  - **Investment** (Choi et al. 2018);
  - **Sales** (Banerjee and Duflo 2014; McKenzie 2017);
  - **Engagement in international trade** (Manova, Wei, and Zhang (2015), Zia (2008), and Minetti and Zhu (2011));
  - **Rentability** (Banerjee and Duflo (2014), McKenzie (2017));
- Since investment and trade flows are engines of entrepreneurship and economic growth, credit constraints jeopardize economic growth and social welfare.

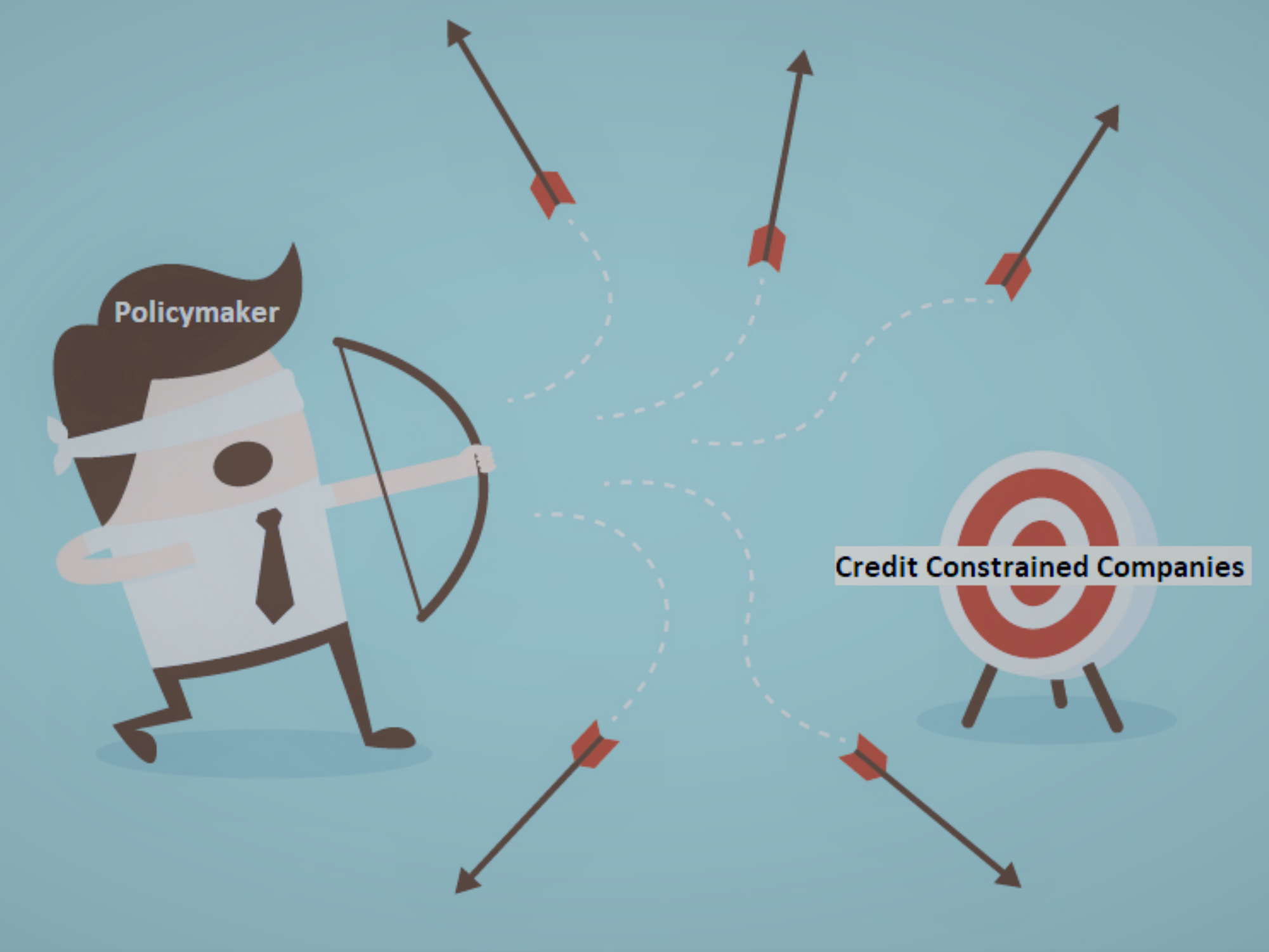
Defining credit constraints

- Constrained companies hold two main characteristics:
  i. access to investment opportunities with **expected returns higher enough to justify their execution**; despite that,
  ii. they are **unable to fund these investments**.
- Formally, we can understand credit-constrained firms as those who cannot equalize the marginal productivity of capital to the opportunity cost of capital in the economy.

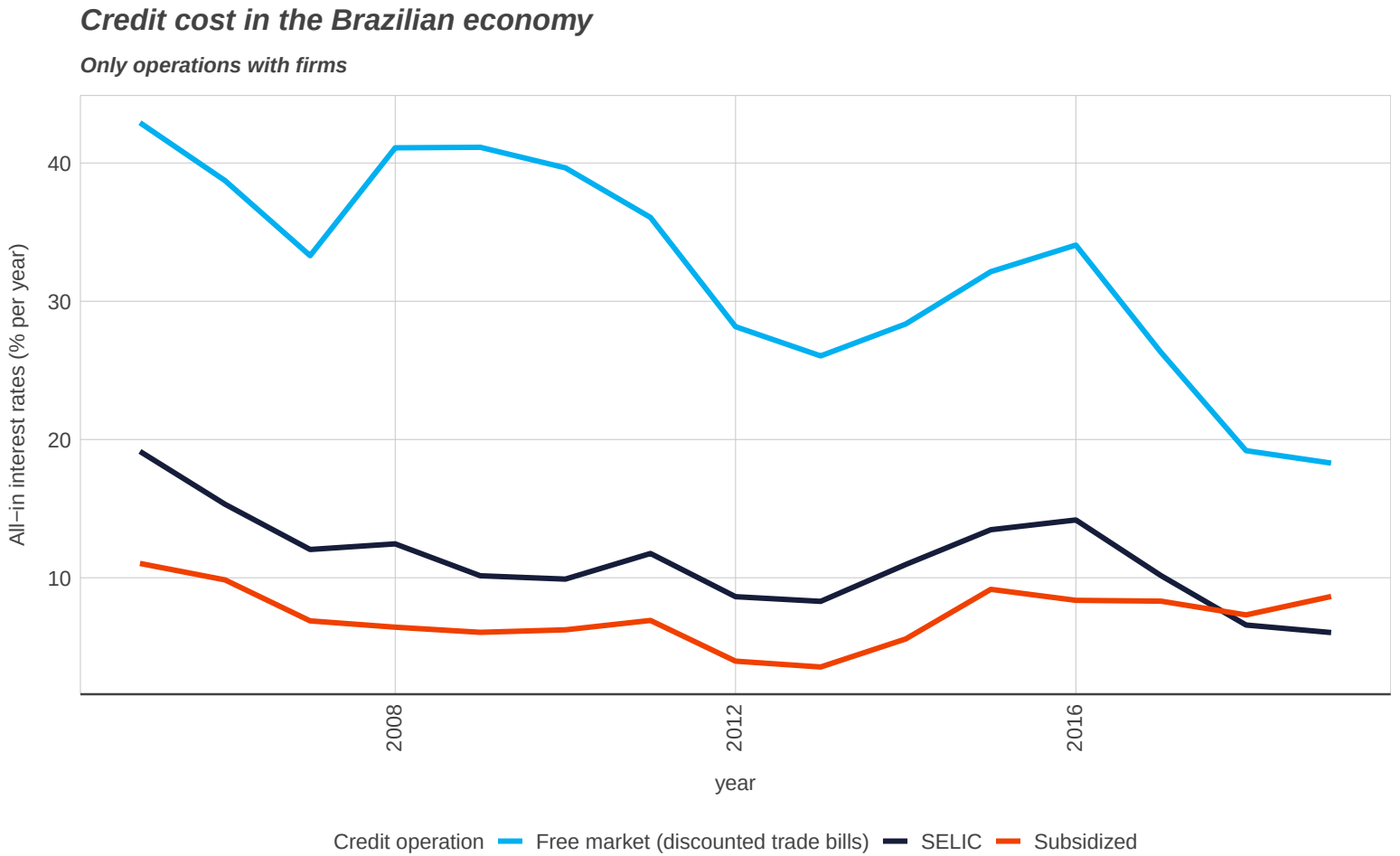
Measuring credit constraints

- Several authors have proposed firm-level measures for credit constraints (Lamont, Polk, and Saa-Requejo 2001; Whited and Wu 2006; Hadlock and Pierce 2010; and Schauer, Elsas, and Breitkopf 2019).
- In the context of a developed economy, they do not seem to work as expected.

> "We find that none of the five measures we evaluate is able to identify firms that behave as if they were in fact constrained." (Farre-Mensa and Ljungqvist 2016, p. 33)


Policymaker
Credit Constrained Companies

The treatment



Source: BCB−DSTAT and BNDES.

The dataset

- RAIS (2012-2017)
  - Information about the firm (age, sector, address)
  - Information about the labor force (number of workers, qualification, earnings)
- SERASA (2012-2017)
  - Accounting information (assets, liabilities and results)
  - Covers a subset of publicly and privately traded companies
- SECEX (1998 - 2018)
  - Export and import status for all Brazilian firms
- BNDES (2002 - 2019)
  - Loans at the firm-level per credit line

The empirical strategy (1/2)

- Triple difference estimator (3D) (Berck and Villas-Boas 2016) combined with Genetic Matching (Diamond and Sekhon 2012).
- Firms were matched within cohorts, that were defined by a time span of four years - tagged as t_{-2} , t_{-1}, t_0, and t_{+1}. Treatment is assigned in t_0.
- Genetic matching pairs observations based on a Generalized Mahalanobis Distance (GMD). The control vector took values observed in years t_{-2} and t_{-1} for the following variables: **number of employees, leverage ratio, year sales, operational profit, cash flow, and the total expenses with interests**.

Balance before matching

Balance between treated and untreated units

X	Period	μ_t	μ_c	$t-ratio$	Γ_{ct}
y	-1	2.90	2.75	4.34	-0.13
employee.size	-1	4.36	3.91	12.66	-0.09
leverage.size	-1	2.23	2.10	3.87	-0.13
sales.size	-1	2.23	2.01	2.64	-1.08
operating.profit	-1	4.58	2.82	1.83	-1.33
cash.flow	-1	129.67	84.27	2.04	-0.003
interest.expenses	-1	-1.24	-2.62	3.03	-0.97
y	-2	2.75	2.66	2.63	-0.12
employee.size	-2	4.27	3.89	10.37	-0.07
leverage.size	-2	2.11	2.02	2.73	-0.12
sales.size	-2	2.23	2.06	1.59	-0.82
operating.profit	-2	4.19	4.00	0.26	-1.47
cash.flow	-2	116.27	79.12	1.78	0.02
interest.expenses	-2	-1.20	-1.71	1.49	-0.90

Untreated units are 66912.
Treated units are 1797.
Variables are in logarithms.
Γ_{ct} calculated according to Rubin and Imbens (2015).

Balance after matching

Balance between treated and control units

X	Period	μ_t	μ_c	$t-ratio$	Γ_{ct}
y	-1	2.92	2.91	0.22	0.01
employee.size	-1	4.39	4.38	0.07	0.01
leverage.size	-1	2.25	2.24	0.14	0.001
sales.size	-1	2.20	2.19	0.15	-0.01
operating.profit	-1	4.62	6.69	-0.91	-0.91
cash.flow	-1	133.00	115.35	0.60	0.22
interest.expenses	-1	-1.25	-1.37	0.24	0.51
y	-2	2.78	2.78	0.08	0.02
employee.size	-2	4.28	4.29	-0.24	0.02
leverage.size	-2	2.14	2.14	-0.01	0.01
sales.size	-2	2.26	2.29	-0.21	0.04
operating.profit	-2	4.24	5.87	-0.87	-1.01
cash.flow	-2	119.44	104.90	0.54	0.27
interest.expenses	-2	-1.22	-1.18	-0.10	0.32

Control units are 1669.
Treated units are 1740.
Variables are in logarithms.
Γ_{ct} calculated according to Rubin and Imbens (2015).

The empirical strategy (2/2)

- The cohorts are "stacked" (Gormley and Matsa 2011; Deshpande and Li 2019; and Joaquim and Doornik 2019), and the 3D estimator is implemented within the matched sample through equation (1):

$$
\begin{aligned}
Y_{i,t} = {} & \alpha_{i,cohort} + \alpha_t + \beta_1 Post_t + \beta_2 BNDES_i + \beta_3 Constr_i \\
& + \beta_4 (Post_t * BNDES_i) + \beta_5 (Post_t * Constr_i) + \\
& + \beta_6 (Post_t * BNDES_i * Constr_i) + \epsilon_{i,t}
\end{aligned} \tag{1}
$$

Results (1/2)

	Impacts on total assests with continuous measures of credit constraints			
	KZ	WW	SA	FCP
d.post	-0.02^{**}	-0.03^{***}	-0.01	-0.08^{***}
	(0.01)	(0.01)	(0.02)	(0.03)
d.post:d.bndes	0.13^{***}	0.13^{***}	0.29^{***}	0.15^{***}
	(0.01)	(0.01)	(0.04)	(0.05)
d.post:kz.index	0.0001^{***}			
	(0.0000)			
d.post:d.bndes:kz.index	0.0000			
	(0.0001)			
d.post:ww.index		-0.0000		
		(0.0000)		
d.post:d.bndes:ww.index		0.0000		
		(0.0000)		
d.post:sa.index			0.01	
			(0.01)	
d.post:d.bndes:sa.index			0.09^{***}	
			(0.02)	
d.post:fcp.index				-0.02
				(0.01)
d.post:d.bndes:fcp.index				0.02
				(0.03)
Observations	13,636	13,496	13,636	2,908
R^2	0.03	0.02	0.03	0.03
Adjusted R^2	-0.30	-0.30	-0.29	-0.30

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered by firm-cohort.

Results (2/2)

	Impacts on total assets with categorical measures of credit constraints			
	KZ	WW	SA	FCP
d.post	−0.02	−0.02	−0.03**	−0.02
	(0.01)	(0.01)	(0.01)	(0.04)
d.post:d.bndes	0.13***	0.13***	0.13***	0.11***
	(0.01)	(0.01)	(0.01)	(0.02)
d.post:kz.dconstrained	−0.05***			
	(0.02)			
d.post:d.bndes:kz.dconstrained	−0.01			
	(0.03)			
d.post:ww.dconstrained		−0.11***		
		(0.02)		
d.post:d.bndes:ww.dconstrained		0.04		
		(0.03)		
d.post:sa.dconstrained			0.003	
			(0.02)	
d.post:d.bndes:sa.dconstrained			0.10***	
			(0.04)	
d.post:fcp.dconstrained				−0.09***
				(0.03)
d.post:d.bndes:fcp.dconstrained				0.05
				(0.04)
Observations	13,636	13,496	13,636	2,908
R^2	0.03	0.03	0.03	0.03
Adjusted R^2	-0.30	-0.30	-0.30	-0.29

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered by firm-cohort.

Robustness check (1/2)

- As a robustness check, we'll use two well-established findings in the literature on financial constraints to evaluate the proposed 3D estimator:
  i. that firms engaged in international trade are typically not credit-constrained (Roberts and Tybout 1997; Zia 2008; Minetti and Zhu 2011; Manova, Wei, and Zhang 2015); and
  ii. that smaller firms are particularly prone to suffer from financial constraints (Beck, Demirgüç-Kunt, and Maksimovic 2005; Beck and Demirguc-Kunt 2006; and Hutchinson and Xavier 2006).

Robustness check (2/2)

Impacts on total assets of subsidized credit (stacking method)

	Heterogeneous impacts in terms of:	
	International Trade	Size
d.post	-0.03^{**}	-0.05^{*}
	(0.01)	(0.03)
d.post:d.bndes	0.15^{***}	0.30^{***}
	(0.01)	(0.04)
d.post:as.factor(international.trade.d)1	-0.004	
	(0.02)	
d.post:d.bndes:as.factor(international.trade.d)1	-0.06^{**}	
	(0.02)	
d.post:employee.size.cohort		0.004
		(0.01)
d.post:d.bndes:employee.size.cohort		-0.04^{***}
		(0.01)
Observations	13,636	13,636
R^2	0.03	0.03
Adjusted R^2	-0.30	-0.29

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered by firm-cohort.

Final Remarks

- Except by the SA index, firms tagged as credit-constrained are not behaving differently from those that are classified as unconstrained.
- Evidently, more in-depth tests must be performed. In particular, it would be essential to use an exogenous credit shock (as Farre-Mensa and Ljungqvist (2016)) to implement a more robust estimation of equation (1).
- Finding a reliable measure is crucial for public initiatives that try to tackle this relevant market failure.

Thank you