Investment of Firms in Brazil: Do Financial Restrictions, Unexpected Monetary Shocks and BNDES Play Important Roles?

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Outline

- Motivation

- Objective

- Data

- Empirical Analysis

- Conclusion

- Extensions

Motivation

- Firm Investment is one of the most important topics in economics
  - Neoclassical Models
    - Tobin (1969)
    - Hayashi (1982)
  - Models with Financial Frictions
    - Kaplan and Zingales (1997)
    - Fazari Hubard and Petersen (FHP) (1998)
    - Campello et al (2013)

Motivation

- Empirical Contributions
  - Mostly OECD countries
    - Real interest rate relatively low and stable
    - Developed capital markets
    - Developed credit markets
  - But how about emerging economies?
    - Not so many papers
    - Financial restrictions should be even more important than in OECD countries

Motivation

- Brazil
  - High levels of real interest rate
  - Not so developed credit and capital markets yet
  - Brazil´s Social Development Bank, BNDES, supplies most of long term financing for investment
  - Oliveira(2012), Oliveira and Ronchi (2012)
    - Small firms are more financially constrained in Brazil
      - They have higher External Finance Premium (EFP) than large firms

Objective

- Estimate investment dynamics for Brazil taking in consideration critical aspects of Brazil´s financial market
  - Financial restrictions
  - Monetary Policy
  - BNDES

Results

- Contractionist unexpected Monetary Shocks are negatively related to investment

- Financial restrictions, measured in several different ways, are negatively related to investment in firms

- The long term financing of investment by BNDES is positively related to investment

- The results are statistically and economically significant

- They are also robust to different econometric techniques, different classifications of financially restricted firms and model specifications

Data

- Original and Partly Confidential Data
- Public Firms
  - Comissão de Valores Mobiliários (CVM) and Economática
    - Quarterly data: 1994Q4 2010Q4
- Private Firms
  - SERASA, Gazeta Mercantil and Valor Econômico
    - Confidential Data (except for Valor Econômico)
    - Annual (most) and very few quarterly data: 1994-2007

Total Number of Firms Classified by Type (Private or Public) and Sectors

	Public	Private
Chemical/Petroleum	36	273
Foods and Beverage	40	90
Mining/Metalurgy	8	31
Eletrical/Eletronic	14	92
Transportation	18	268
Public Services	30	91
Textile	35	75
Services	39	1110
Others	71	3815
Total	291	4,735

Financial Indicators by Sectors of the Economy

Sectors	N	Log(Assets)	Net Operational Revenues/Assets	Q	Cash Flow/Assets	Leverage	**Total**
Chemical/Petroleum	309	19.01	0.64	1.13	0.07	0.43	15
Food and Beverages	130	18.14	0.49	0.89	0.08	0.31	24
Mining/Metallurgy	39	18.17	0.39	1.12	0.13	0.68	26
Electro/Electronic Equipment	106	18.21	0.52	0.95	0.091	0.34	32
Transportation	286	18.19	0.38	1.02	0.1	0.61	20
Public Services	121	18.09	0.62	1.01	0.04	0.63	46
Textiles	110	18.42	0.58	0.73	0.15	0.48	29
Services	1149	11.35	0.28	0.72	0.16	0.34	35
Others	3886	10.01	0.66	0.68	0.19	0.26	166
Total	5,026						393

Financial Characteristics of Firms Separating by Quarterly and Annual Information

Financial Characteristics	Quartelly Data (A)				Annual Data (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	393	18.31	18.05	4.19	4735	17.17	17.05	3.51
Operational revenues/Ass ets	393	0.68	0.6	0.85	4735	0.36	0.18	0.58
Financial Expenses/Ass ets	393	0.19	0.18	0.35	4735	0.19	0.19	0.42
Fixed Assets/ Assets	393	0.47	0.53	0.46	4735	0.36	0.36	0.83
Short-term Debt/Assets)	393	0.68	0.65	0.91	4735	0.49	0.17	0.15
Long-term Debt/Assets	393	0.23	0.19	0.17	4735	0.09	0.12	0.13
Capex/Assets	393	0.076	0.082	0.01	4735	0.067	0.068	0.14
Q	393	1.35	1.39	0.21	4735	1.43	1.58	0.03
Cash Flow/Assets	393	0.13	0.124	0.32	4735	0.1	0.12	0.05
ROA	393	0.15	0.13	0.11	4735	0.1	0.14	0.001
Payout ratio	393	0.27	0.24	1.46	4735	0.18	0.23	0.53
BNDES Loans	62				44			

BNDES Financing

Sector	Number of Firms
Foods and beverages	18
Retail	7
Construction	6
Electro-electronics	3
Industrial Machinery	3
Mining	4
Non-metallic minerals	0
Pulp and paper	5
Oil and gas	6
Chemical	11
Metallurgy and steelmaking	11
Textile	9
Transportation	6
Vehicles and Spare Parts	3
Agriculture and fisheries	0
Others	17
Total	106

Classification Criteria

- Size
  - Oliveira (2012), Oliveira and Ronchi (2012)
- Dividends
  - Fazari, Hubbard and Petersen (1988)
- KZ Index
  - Kaplan and Zingales (1997)
- WW Index (Whited and Wu index)
  - Whited and Wu (2006)
- Extenal Finance Premium (EFP)
  - Oliveira (2013)

Size Quarterly data

Financial Characteristics	Non Restricted (A)				Restricted (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	58	18.31	18.05	4.19	92	17.17	17.05	3.51
Operational revenues/Assets	58	0.68	0.6	0.85	92	0.36	0.18	0.58
Financial Expenses/Assets	58	0.19	0.18	0.35	92	0.19	0.19	0.42
Fixed Assets/ Assets	58	0.47	0.53	0.46	92	0.36	0.36	0.83
Short-term Debt/Assets	58	0.68	0.65	0.91	92	0.49	0.17	0.15
Long-term Debt/Assets	58	0.23	0.19	0.17	92	0.09	0.12	0.13
Capex/Assets	58	0.082	0.079	0.001	92	0.054	0.051	0.001
Q	58	1.06	1.04	0.003	92	1.01	1.37	0.023
Cash Flow/Assets	58	0.153	0.162	0.002	92	0.121	0.132	0.003
BNDES Loans	20				8			

Dividends Annual Data

Financial Characteristics	Non restricted (A)				restricted (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	70	11.87	11	3.51	513	8.3	8.36	3.26
Operational revenues/Assets	70	0.61	0.42	2.65	513	0.29	0.42	0.32
Financial Expenses/Assets	70	0.15	0.05	1.28	513	0.18	0.18	0.49
Fixed Assets/ Assets	70	0.63	0.35	0.43	513	0.42	0.39	0.52
Short-term Debt/Assets)	70	0.41	0.41	0.61	513	0.34	0.17	0.61
Long-term Debt/Assets	70	0.32	0.05	0.31	513	0.23	0.26	0.42
Capex/Assets	70	0.058	0.083	0.005	513	0.024	0.0024	0.012
Q	70	1.01	1.045	0.0042	513	1.57	1.79	0.038
Cash Flow/Assets	70	0.16	0.178	0.038	513	0.132	0.142	0.025
BNDES Loans	20				5			

KZ Index Quarterly Data

Financial Characteristics	Non restricted (A)				restricted (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	78	11.87	11.0	3.51	182	8.32	8.70	4.76
Operational revenues/Assets	78	0.61	0.42	2.65	182	0.31	0.47	0.49
Financial Expenses/Assets	78	0.15	0.05	1.28	182	0.19	0.16	0.29
Fixed Assets/ Assets	78	0.63	0.35	0.43	182	0.47	0.31	0.61
Short-term Debt/Assets)	78	0.41	0.41	0.61	182	0.39	0.14	0.51
Long-term Debt/Assets	78	0.32	0.05	0.31	182	0.28	0.23	0.29
Capex/Assets	78	0.074	0.062	0.003	182	0.042	0.061	0.003
Q	78	1.03	1.08	0.004	182	1.48	1.38	0.124
Cash Flow/Assets	78	0.143	0.166	0.001	182	0.131	0.134	0.035
BNDES Loans	36				06			

WW Index Annual Data

Financial Characteristics	Non restricted (A)				restricted (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	48	18.21	18.02	4.02	98	17.1	17.25	3.52
Operational revenues/Assets	48	0.67	0.64	0.83	98	0.32	0.12	0.52
Financial Expenses/Assets	48	0.12	0.19	0.32	98	0.13	0.12	0.45
Fixed Assets/ Assets	48	0.42	0.56	0.42	98	0.32	0.35	0.81
Short-term Debt/Assets)	48	0.65	0.61	0.96	98	0.42	0.12	0.19
Long-term Debt/Assets	48	0.22	0.11	0.13	98	0.29	0.14	0.11
Capex/Assets	48	0.071	0.062	0.034	98	0.042	0.042	0.042
Q	48	0.92	1.15	0.019	98	1.61	1.37	0.137
Cash Flow/Assets	48	0.142	0.174	0.063	98	0.181	0.121	0.025
BNDES Loans	32				7			

EFP Quarterly Data

Financial Characteristics	Non restricted (A)				restricted (B)			
	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
Log(Assets)	65	18.31	18.05	4.19	96	17.17	17.05	3.51
Operational revenues/Assets	65	0.68	0.6	0.85	96	0.36	0.18	0.58
Financial Expenses/Assets	65	0.19	0.18	0.35	96	0.19	0.19	0.42
Fixed Assets/ Assets	65	0.47	0.53	0.46	96	0.36	0.36	0.83
Short-term Debt/Assets	65	0.68	0.65	0.91	96	0.49	0.17	0.15
Long-term Debt/Assets	65	0.23	0.19	0.17	96	0.09	0.12	0.13
Capex/Assets	65	0.082	0.079	0.001	96	0.054	0.051	0.001
Q	65	1.06	1.04	0.003	96	1.47	1.37	0.023
Cash Flow/Assets	65	0.153	0.162	0.002	96	0.121	0.132	0.003
BNDES Loans	36				9			

Monetary Contractionist Shocks

- Nominal SELIC rate

- Boshen-Mills (1995) index for Brazil´s COPOM

- Shocks
  - Q4 1997
  - Q4 1998
  - Q2 1999
  - Q4 2002

Investment Model

- Extension of FHP (1998)
- Unbalanced Panel Data
  - Random Effects
- Dependent Variable: Capex/Assets
- Regressors
  - Tobin Q
  - Cash Flow/Assets
  - Dummies
    - BNDES, Monetary Contraction and Financial Restriction
      - Alone
      - Interacting with themselves and with Cash Flow

Panel A
Firms with Quarterly Data

	Size	Dividends	KZ	WW	EFP
Cash Flow$_{it}$/Assets$_{it-1}$	0.12	0.13	0.04	0.04	0.02
	(0.02)	(0.02)	(0.02)	(0.09)	(0.00)
Q_{it}	0.12	0.26	0.41	0.25	0.12
	(0.01)	(0.03)	(0.58)	(0.02)	(0.83)
Shock$_t$	-0.02	-0.08	-0.09	-0.02	-0.04
	(0.01)	(0.01)	(0.02)	(0.01)	(0.09)
FR$_i$*Shock$_t$*(Cash Flow$_{it}$/Assets$_{it-1}$)	0.08	0.04	0.04	0.17	0.02
	(0.02)	(0.18)	(0.02)	(0.19)	(0.04)
BNDES$_i$	0.04	0.04	0.03	0.02	0.01
	(0.034)	(0.02)	(0.02)	(0.04)	(0.09)
FR$_i$	-0.04	-0.04	-0.02	-0.08	-0.07
	(0.01)	(0.09)	(0.01)	(0.05)	(0.01)
BNDES$_i$*FR$_i$*Cash Flow$_{it}$/Assets$_{it-1}$	-0.03	-0.02	-0.01	-0.04	-0.07
	(0.02)	(0.04)	(0.08)	(0.01)	(003)
FR*Shock$_t$	-0.02	-0.03	-0.04	0.05	-0.02
	(0.14)	(0.017)	(0.03)	(0.01)	(008)
FR$_i$*(Cash Flow$_{it}$/Assets$_{it-1}$)	0.02	0.05	0.02	0.04	0.03
	(004)	(004)	(000)	(012)	(001)
	0.01	0.03	0.04	0.12	0.15

Panel B
Firms with Annual Data

	Size	Dividends	KZ	WW	EFP
Cash Flow$_{it}$/Assets$_{it-1}$	0.13	0.18	0.04	0.01	0.02
	(0.01)	(0.02)	(0.02)	(0.05)	(0.01)
Q_{it}	0.16	0.19	0.24	–0.37	0.36
	(0.02)	(0.02)	(0.13)	(0.02)	(0.26)
Shock$_t$	–0.01	–0.04	–0.02	–0.05	–0.01
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
FR$_i$*Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.04	0.04	0.03	0.02	0.02
	(0.01)	(0.13)	(0.01)	(0.13)	(0.04)
BNDES$_i$	0.04	0.05	0.08	0.08	0.08
	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)
FR$_i$	–0.02	–0.01	–0.02	–0.03	–0.08
	(0.03)	(0.08)	(0.04)	(0.10)	(0.03)
FR$_i$*Shock$_t$	–0.03	–0.01	–0.05	–0.05	–0.04
	(0.04)	(0.02)	(0.08)	(0.08)	(0.03)
Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.02	0.04	0.06	0.04	0.03
	(0.13)	(0.06)	(0.02)	(0.01)	(0.04)
FR*Shock$_t$	–0.12	–0.08	–0.14	–0.02	–0.21
	(0.34)	(0.21)	(0.18)	(0.01)	(0.08)
FR$_i$*(Cash Flow$_{it}$/Assets$_{it-1}$)	0.03	0.01	0.04	0.03	0.05
	(0.12)	(0.10)	(0.03)	(0.02)	(0.00)
BNDES$_i$*FR$_i$	0.02	0.04	0.01	0.03	0.15
	(0.13)	(0.20)	(0.10)	(0.10)	(0.02)
BNDES$_i$*Cash Flow$_{it}$/Assets$_{it-1}$	–0.03	–0.01	–0.05	–0.12	–0.03
	(0.04)	(0.02)	(0.03)	(0.03)	(0.08)
BNDES*FR*(Cash Flow$_{it}$/Assets$_{it-1}$)*	–0.03	–0.05	–0.10	–0.14	–0.07
	(0.01)	(0.01)	(0.00)	(0.08)	(0.01)

Wald Tests

	Size	Dividends	KZ	WW	EFP
(FR$_i$+Shock$_t$+BNDES$_i$)	0.01	0.00	0.04	–0.01	–0.01
	(0.08)	(0.01)	(0.08)	(0.03)	(0.16)
(Shock$_t$+FR$_i$)	–0.03	–0.05	–0.04	0.00	–0.09
	(0.10)	(0.01)	(0.08)	(002)	(0.04)
($\sum$ Cash Flow$_{it}$/Assets$_{it-1}$ without BNDES)	0.09	0.04	0.13	–0.08	0.10
	(0.12)	(0.08)	(0.02)	(0.03)	(0.00)
($\sum$ Cash Flow$_{it}$/Assets$_{it-1}$ with BNDES)	0.09	–0.02	–0.02	0.09	0.00
	(0.14)	(0.23)	(0.03)	(0.01)	(0.13)

Robustness Tests

- Separating between Financially and Non-Financially Restricted

- Lagged Investment Effect

- Using the Intersection Classification Criteria

- Investment of Firms and Financial Crisis

- Financial Restrictions and Other Control Variables

Panel A Financial Crisis Firms with Quarterly Data

	Size	Dividends	KZ	WW	EFP
Cash Flow$_{it}$/Assets$_{it-1}$	0.08 (0.28)	0.09 (0.02)	0.04 (0.62)	0.01 (0.28)	0.07 (0.31)
Q_{it}	0.12 (0.01)	0.31 (0.08)	0.33 (0.48)	0.35 (0.02)	0.42 (0.49)
Shock$_t$	–0.03 (0.02)	–0.04 (0.04)	–0.09 (0.02)	–0.08 (0.032)	–0.03 (0.01)
FR$_i$*Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.07 (0.01)	0.03 (0.09)	0.06 (0.02)	0.08 (0.18)	0.07 (0.02)
FR$_i$	–0.09 (0.00)	–0.04 (0.14)	–0.08 (0.04)	–0.09 (0.12)	–0.05 (0.08)
FC$_t$	–0.02 (0.04)	–0.01 (0.00)	–0.03 (0.15)	–0.08 (0.04)	–0.12 (0.13)
BNDES$_i$	0.01 (0.054)	0.04 (0.02)	0.12 (0.02)	0.10 (0.01)	0.09 (0.02)
BNDES$_i$*FR$_i$*CashFlow$_{it}$/Assets$_{it-1}$	–0.02 (0.03)	–0.11 (0.23)	–0.04 (0.03)	–0.13 (0.15)	– 0.02 (0.03)
FR$_i$*Shock$_t$	–0.13 (0.05)	–0.12 (0.03)	–0.14 (0.10)	–0.02 (0.00)	–0.01 (0.00)
FR$_i$*Cash Flow$_{it}$/Assets$_{it-1}$	0.15 (0.05)	0.04 (0.06)	0.04 (0.03)	0.01 (0.10)	0.02 (0.10)
Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.13 (0.24)	0.09 (0.03)	0.12 (0.03)	0.08 (0.04)	0.09 (0.03)
BNDES$_i$*FR$_i$	–0.14 (0.00)	0.01 (0.12)	0.06 (0.40)	–0.04 (0.34)	0.12 (0.12)
BNDES$_i$*CashFlow$_{it}$/Assets$_{it-1}$	–0.15 (0.23)	–0.09 (0.00)	–0.02 (0.01)	–0.07 (0.00)	0.00 (0.13)

Panel B Other control Variables

	Size	Dividends	KZ	WW	EFP
Cash Flow$_{it}$/Assets$_{it-1}$	0.14 (0.27)	0.01 (0.02)	0.04 (0.03)	0.02 (0.01)	0.08 (0.02)
Q$_{it}$	0.15 (0.01)	0.25 (0.07)	0.29 (0.17)	0.31 (0.01)	0.38 (0.13)
Shock$_t$	-0.02 (0.01)	-0.03 (0.02)	-0.18 (0.04)	-0.07 (0.04)	-0.07 (0.02)
FR$_i$*Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.08 (0.04)	0.03 (0.15)	0.03 (0.04)	0.02 (0.14)	0.02 (0.01)
FR$_i$	-0.03 (0.02)	-0.02 (0.15)	-0.06 (0.02)	-0.01 (0.15)	-0.04 (0.18)
BNDES$_i$	0.03 (0.02)	0.14 (0.03)	0.11 (0.04)	0.04 (0.05)	0.07 (0.17)
BNDES$_i$*FR$_i$*CashFlow$_{it}$/Assets$_{it-1}$	-0.04 (0.01)	-0.23 (0.18)	-0.15 (0.09)	-0.03 (0.15)	- 0.18 (0.04)
Leverage$_{it}$/ Assets$_{it-1}$	-0.11 (0.28)	-0.16 (0.04)	-0.18 (0.10)	-0.39 (0.09)	-0.31 (0.11)
Sales$_{it}$/ Assets$_{it-1}$	0.06 (0.01)	0.02 (0.08)	0.01 (0.02)	0.24 (0.02)	0.03 (0.02)
Growth of Sales$_{it}$/ Assets$_{it-1}$	0.24 (0.01)	0.12 (0.21)	0.10 (0.01)	0.09 (0.01)	(0.01)
Cash$_{it}$/ Assets$_{it-1}$	0.25 (0.01)	0.02 (0.18)	0.21 (0.10)	0.18 (0.03)	0.15 (0.03)
FR$_i$*Shock$_t$	-0.03 (0.00)	-0.10 (0.12)	-0.04 (0.12)	-0.13 (0.00)	-0.21 (0.31)
FR$_i$*Cash Flow$_{it}$/Assets$_{it-1}$	0.22 (0.03)	0.15 (0.01)	0.41 (0.28)	0.30 (0.09)	0.02 (0.00)
Shock$_t$*Cash Flow$_{it}$/Assets$_{it-1}$	0.10 (0.01)	0.01 (0.00)	0.13 (0.21)	0.04 (0.02)	-0.13 (014)
BNDES$_i$*FR$_i$	0.03 (0.14)	0.04 (0.10)	0.02 (0.12)	0.01 (0.06)	0.03 (017)
BNDES$_i$*CashFlow$_{it}$/Assets$_{it-1}$	-0.015 (003)	-0.01 (0.24)	-0.12 (0.08)	-0.02 (0.14)	- 0.03 (0.08)

Conclusions

- Very relevant expanatory variables to explain investment of firms in Brazil
  - Financial Restrictions
  - BNDES
  - Unexpected Monetary Contractionist Shocks
- Results robust and very impressive (and somewhat expected as well)

Conclusions

- Investment is fundamental to growth
- In terms of policy, Brazil should stress those that increase the supply of long term investment for constrained firms
  - Not necessarily BNDES
    - Fiscal Aspects
    - Increases Public Debt
  - Create the incentives (mechanisms) for private savings to be used to finance investment

Extensions

- Include Foreign Direct Investment data

- Use Unexpected Expansionist Monetary Policy also

- Recent Data on BNDES Financing