Effects of Monetary Policy on Firms in Brazil: An Empirical Analysis of the Balance Sheet Channel

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Motivation

- Understand the monetary transmission mechanisms
  - Traditional channels
  - Credit channels
- Are the credit channels important for Brazil?
- How do the brazilian firms respond to monetary policy, in particular monetary contractions?
- Lack of empirical studies for Brazil

Relevance for Brazil

- High interest rates
- A growing but still restricted capital market
- Credit/GPD still far less than OECD countries
- Ineffective judiciary system
- Central Bank of Brazil: understand the effectiveness of monetary policy

What are the questions we will try to answer?

- Is the balance sheet channel relevant in Brazil?
  - How do small and large firms respond to monetary contractions?
- Empirical analysis
- Main reference
    - Gertler e Gilchrist (1994) “Monetary Policy, Business Cycle, and the Behavior of Small Manufacturing Firms” – Quarterly Journal of Economics

Results

- Empirical evidences indicate
  - Small firms are more sensitive to monetary policy than large firms
    - Balance sheet of firms
    - Inventories
    - Net operational revenue
    - Long term debt
  - External financial premium of small firms is greater than the external financial premium of large firms

Transmission Monetray Mechanisms

- Traditional channels
  - Interest rate channel
    - IS-LM
    - ↑i(real) ⇨ ↓I ⇨ ↓Y
  - Foreign exchange rate channel
    - ↑i ⇨ Foreign exchange appreciation ⇨ ↓Net exports ⇨ ↓Y
  - Asset Prices channel
    - ↑i ⇨ ↓*q* de Tobin ⇨ ↓I ⇨ ↓Y
    - ↑i ⇨ ↓Wealth⇨ ↓Consumtion⇨ ↓Y

Transmission Monetray Mechanisms

- Credit channels
  - Information assymetry
    - Adverse selection and moral hazard
    - Credit rationing
  - Lending channel
    - ↑i ⇨ ↓supply of loans ⇨ ↓ I ⇨ ↓ Y
    - Credit rationing and balance sheet of banks
    - Hypotheses: there are no perfect substitutes for demand deposits

Balance Sheet Channel

- External finance premium
  - Diference between the cost of external and internal finance
  - Agency costs
  - Principal and Agent Models

- Direct effects
  - ↑i ⇨ ↓Asset ⇨ ↓Colateral ⇨ ↑Risk ⇨ ↓I ⇨ ↓Y
  - ↑i ⇨ ↑ Financial expenses ⇨ ↓cash flow

- Indirect effects
  - ↑i ⇨ ↓Consumption ↓Revenues ⇨ ↓ Cash flow
  - ↑i ⇨ ↓Assets ⇨ ↑ Financial Stress

Credit Channels

- Bernanke e Gertler (1983)
  - Credit channels complement the traditional channels
- Mishkin (1996)
  - Empirical evidences of lending channel in OECD are fragile
  - Empirical evidence of balance sheet channel are more robust in OECD
    - Not many empirical evidences for emerging markets

Credit Channels

- Monetary policy can affect the real sector without significant changes in interest rates
- How monetary contractions influence investment and inventories
- Impact of monetary policy is not always the same
  - Depends on the state of the balance sheet of households and firms

Identification

- Bernanke, Gertler and Gilchrist (1996)
  - Macroeconomy
    - Very difficult
  - Microdata is better
    - Characteristics of firms
    - Access to financial markets
      - Large and small
    - In periods of financial stress
      - Balance sheet os small firms should constrain more their decisions to invest

Data

- Public Firms
  - Comissão de Valores Mobliários (DFP CVM) and Economática
    - Quartely data: 1994Q4 2005Q4
- Private Firms
  - SERASA and Gazeta Mercantil
    - Confidential Data
    - Anual (most) and very few quarter data: 1997-2007

- Firms Size (total assets)
  - Indication of access to capital and financial markets
  - Large
    - Above 70º percentile in at least one quarte or year
  - Small
    - Less than 30º percentile in at least one quarte or year

Panel A Small and Large Firms with Quarterly Information by Sectors of the Economy

Industries	Large			Sma ll			Total
	N	Log(Assets)	Net Operational Revenues/Assets	N	Log(Assets)	Net Operational Revenues/Assets	
Chemical Petroleum	2	17.35	0.63	0	15.32	0.43	15
Food and Beverages	8	13.22	0.47	10	11.21	0.55	24
Mining Metallurgy	4	12.32	0.45	8	10.43	0.62	26
Elec tro/Electronic Equiptment	1	11.25	0.33	8	9.10	0.31	32
Transportation	3	10.22	0.18	6	8.41	0.44	20
Public Services	17	12.12	0.41	6	10.11	0.56	46
Textiles	0	11.24	0.23	8	9.12	0.62	29
Services	2	11.43	0.46	9	8.34	0.44	35
Others	29	10.22	0.52	49	9.23	0.21	166
Total	66			102			393

Panel B Financial Characteristics of Firms with Quarterly information

Financial Characteristics	Large Firms (A)				Small Firms (B)			
	N	Mean	Median	Standard Deviation	N	Average	Median	Standard Deviation
Log(Assets)	66	16.21	11.5	3.15	102	12.18	9.48	3.67
Operational revenues/Assets	66	0.63	0.96	0.75	102	0.21	0.14	0.45
Financial Expenses/Assets	66	0.13	0.11	0.21	102	0.07	0.08	0.21
Fixed Assets/ Assets	66	0.63	0.42	0.31	102	0.54	0.18	0.65
ShortTerm Debt/Assets	66	0.65	0.61	0.86	102	0.54	0.18	0.65
Long Term Debt/Assets	66	0.18	0.05	0.12	102	0.09	0.15	0.23
BNDES Loans	34 (51%)				21 (21%)			

Panel C Mean Tests of Financial Characteristics of Large and Small Firms with Quarterly Information

	Mean Tests		
	4T1994	**1T2000**	**3T2007**
Ln(Assets)	4.51 (0.000)	4.76 (0.000)	5.42 (0.000)
Ln(inventories)	2.65 (0.000)	3.36 (0.000)	2.95 (0.000)
Ln(net operational revenues)	3.34 (0.000)	3.88 (0.000)	4.42 (0.000)
Ln(short term debt)	3.24 (0.000)	3.96 (0.000)	4.65 (0.000)
Ln(longTerm Commercial Paper)	1.53 (0.02)	1.86 (0.06)	1.58 (0.04)

Panel D Small and Large Private Firms with End of the Year Information and Sectors of the Economy

Industries	Large			Small			Total (2002)
	N	Log(Assets)	Net Operational Revenues /Assets	N	Log(Assets)	Net Operational Revenues/Assets	
Chemical Petroleum	8	12.16	0.62	3	9.23	0.57	115
Food and Beverages	18	9.22	0.42	9	10.43	0.35	139
Mining Metallurgy	9	11.23	0.21	4	10.21	0.26	129
Electro/Electronic Equiptment	6	10.15	0.52	5	11.12	0.15	34
Transportation	8	9.22	0.59	6	8.73	0.21	101
Public Services	12	8.33	0.48	3	7.25	0.46	42
Textiles	11	8.24	0.13	8	9.24	0.75	145
Services	4	19.51	0.21	36	11.34	0.61	104
Others	18	13.20	0.37	28	7.02	0.355	3,988
Total	77			102			4,797

Panel E Financial Characteristics of Private Firms with End of the Year Information

Financial Characteristics	Large Firms (A)				Small Firms (B)			
	N	Mean	Median	Standard Deviation	N	Average	Median	Standard Deviation
Log(Assets)	77	11.79	10.0	3.42	102	8.10	8.50	4.96
Operational revenues/Assets	77	0.53	0.91	2.50	102	0.21	0.46	0.46
Financial Expenses/Assets	77	0.11	0.03	1.18	102	0.18	0.13	0.28
Fixed Assets/ Assets	77	0.56	0.25	0.35	102	0.37	0.33	0.56
ShortTerm Debt/Assets)	77	0.31	0.42	0.66	102	0.41	0.12	0.35
Short Term Dollar Debt/(Assets)	77	0.15	0.21	0.31	102	0.21	0.34	0.25
LongTerm Commercial Paper/Assets	77	0.12	0.06	0.21	102	0.18	0.21	0.19

Panel F Mean Tests of Financial Characteristics of Large and Small Private Firms with End of the Year Financial Statements

	Mean Tests		
	1997	**2002**	**2004**
Ln(Assets)	3.125 (0.000)	6.01 (0.000)	2.166 (0.000)
Ln(inventories)	1.312 (0.000)	1.897 (0.000)	2.369 (0.000)
Ln(net operational revenues)	2.412 (0.000)	3.502 (0.000)	4.472 (0.000)
Ln(short term debt)	3.087 (0.000)	4.455 (0.000)	4.213 (0.000)
Ln(longTerm Commercial Paper)	2.35 (0.05)	1.15 (0.06)	1.57 (0.09)

Identifying Monetary Shocks

- Monetary Shocks
  - Bernanke e Blinder
    - SELIC
      - Nominal and Real SELIC:first difference greater than mean plus standard deviation
  - Boshen-Mills(1995)
    - COPOM Meetings and other official documents
    - Strongly contractionist is a shock
    - There are other possibilities
      - Strongly expansionist
      - Weakly expansionist
      - Neutral
      - Weakly contractionist

Panel A Nominal SELIC Rate

	First Phase of Real Plan	Second Phase of Real Plan	Third Phase of Real Plan	Whole Sample	Shocks
	1994/4 to 1998/3	**1998/4 to 2002/4**	**2002/5 to 2007/4**	**1994/4 to 2005/4**	**1995/2 1997/4 1998/4**
Mean of First Difference	-0.018	-0.0019	-0.003	-0.008	0.14
Standard deviations SELIC First Difference	0.082	0.046	-0.0024	0.057	0.017
Median of First Difference	-0.018	-0.0021	0.0009	-0.0031	0.15

Panel B Real Ex-post SELIC Rate

	First Phase of Real Plan	Second Phase of Real Plan	Third Phase of Real Plan	Whole Sample	Shocks
	1994/4 to 1998/3	**1998/4 to 2002/4**	**2002/5 to 2007/4**	**1994/4 to 2005/4**	**1995/2 1997/4 1998/4**
Mean of First Difference	0.013	-0.0082	0.0138	0.035	0.18
Standard deviations SELIC First Difference	0.086	0.051	0.0098	0.047	0.08
Median of First Difference	-0.00067	-0.0056	0.0027	-0.0019	0.14

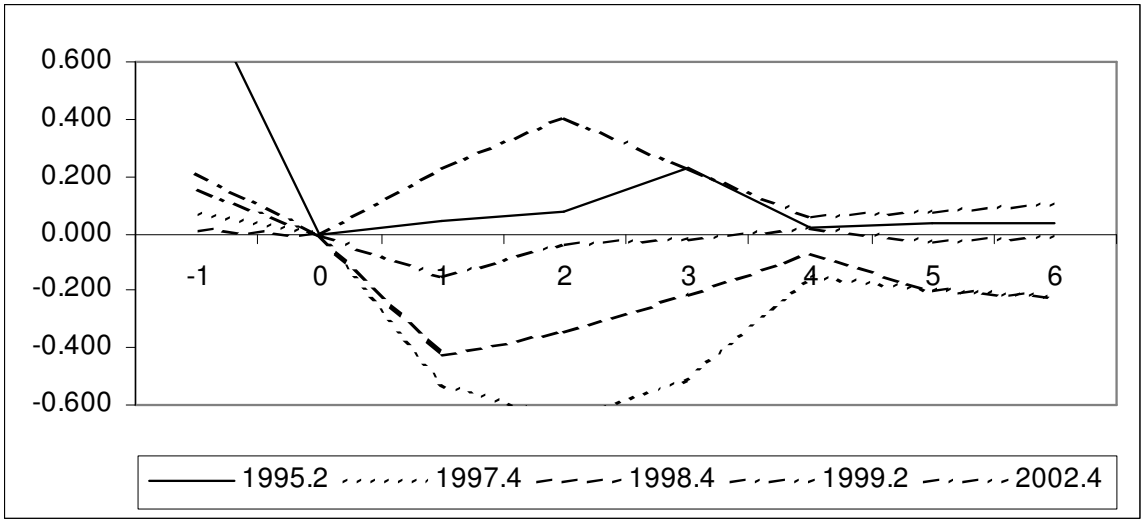
Panel C Boshen-Mills (1995)

	First Phase of Real Plan	Second Phase of Real Plan	Third Phase of Real Plan
	1994/4 1998/3	**1998/4 to 2002/4**	**2003/1 2007/4**
Very Expansionist	3	0	0
Moderately Expansionist	2	5	12
Neutral	1	16	13
Moderately Contactionist	1	13	23
Very Contractionist	2 1995/2, 1997/4 and 1998/4	1 1999/2	1 2002/4

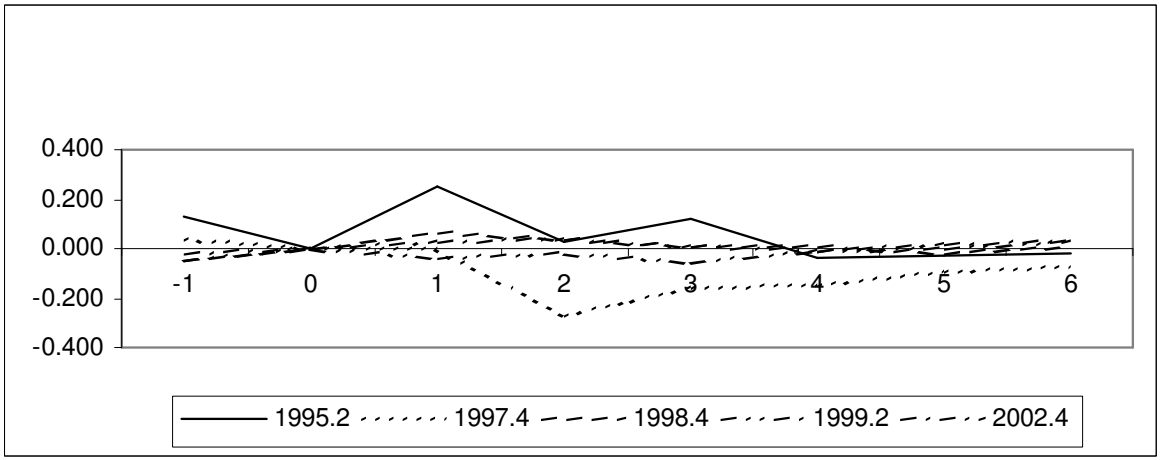
Graph 1 – Growth Rates of Inventories/Assets near Monetary Contractions

Non Accumulated Averages

Small Firms



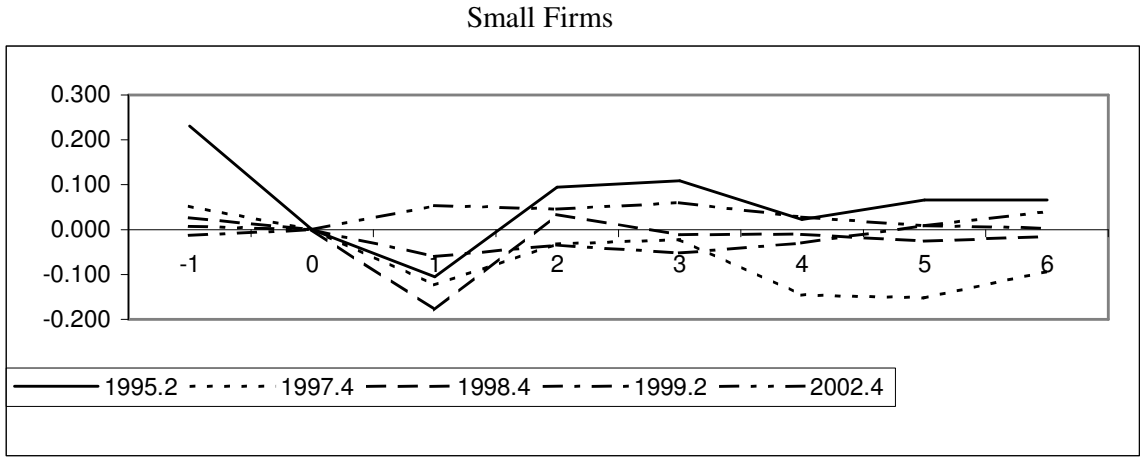
Large Firms



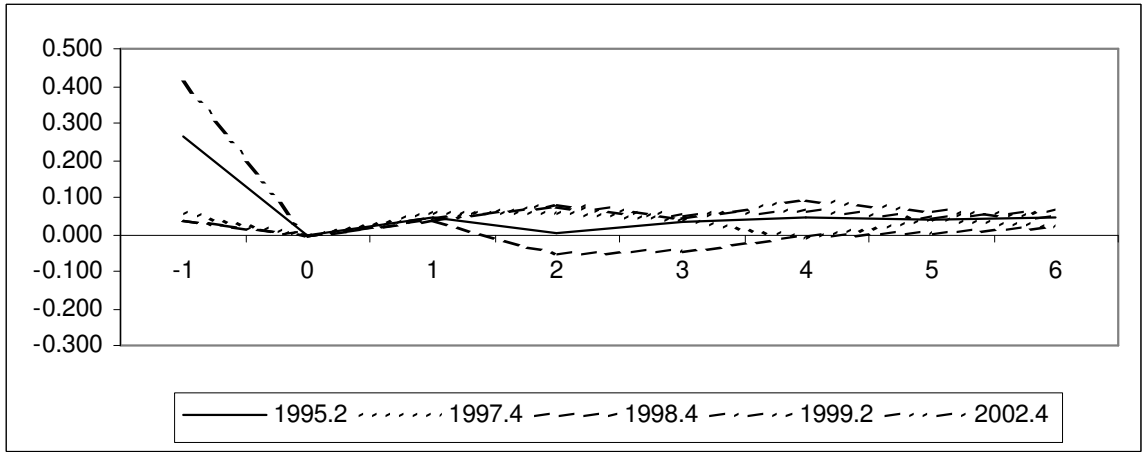
Graph 1 – Growth Rates of Net Operational Revenues/Assets near Monetary Contractions

Non Accumulated Averages

Large Firms



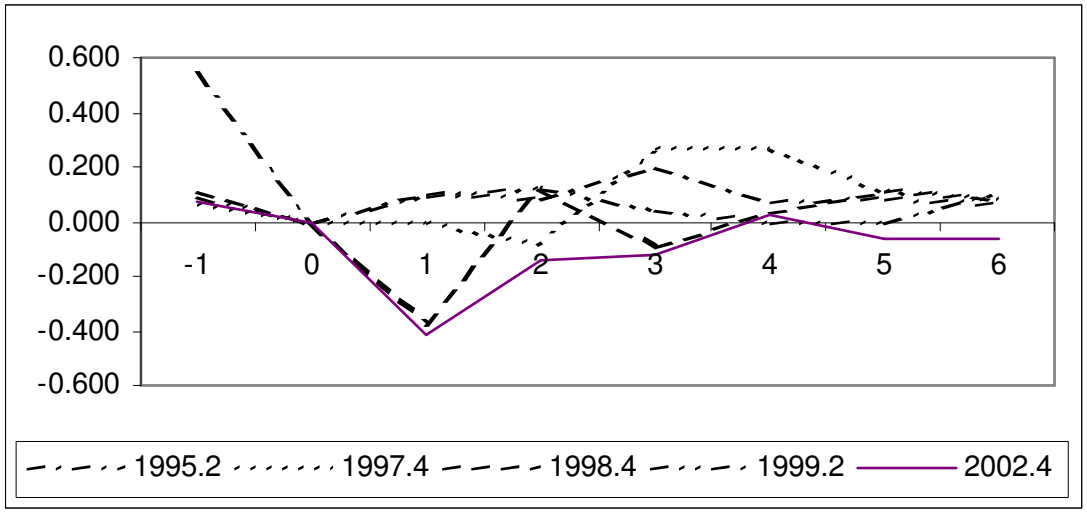
Small Firms



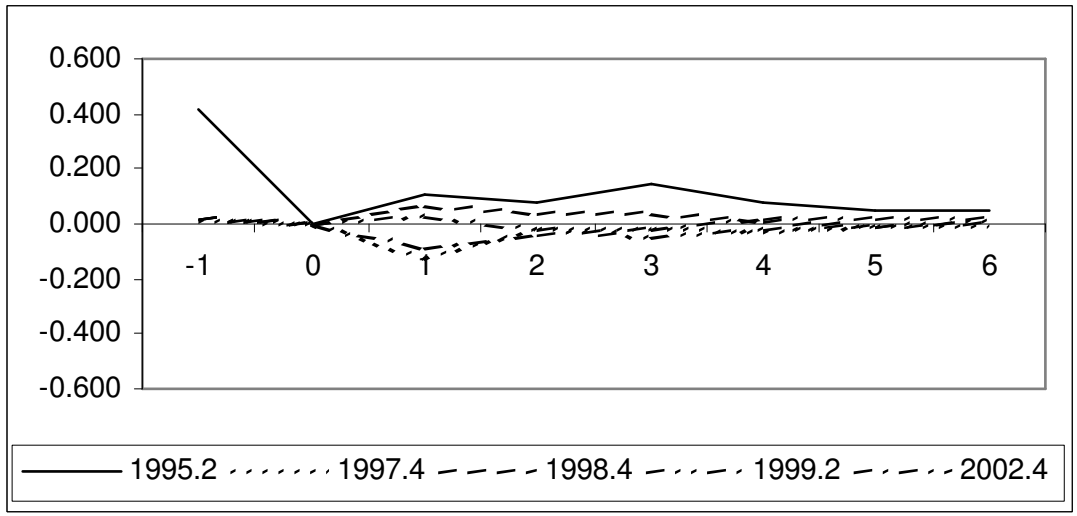
Graph 1 – Growth Rates of Short-Term Debt/Assets near Monetary Contractions

Non accumulated Averages

Small

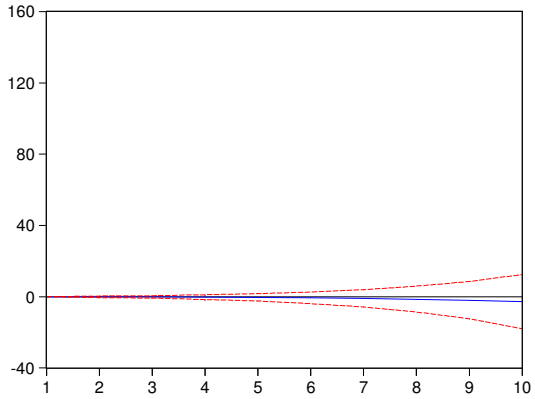


Large

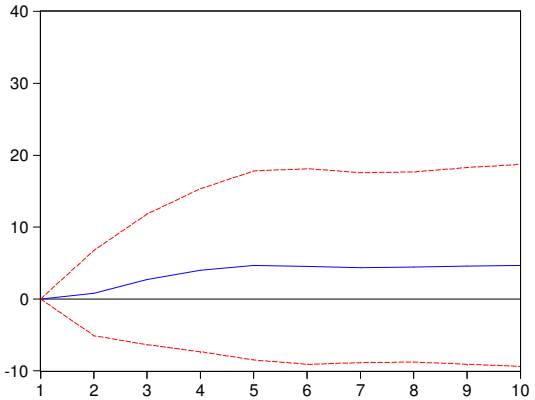


Small Firms	Large Firms

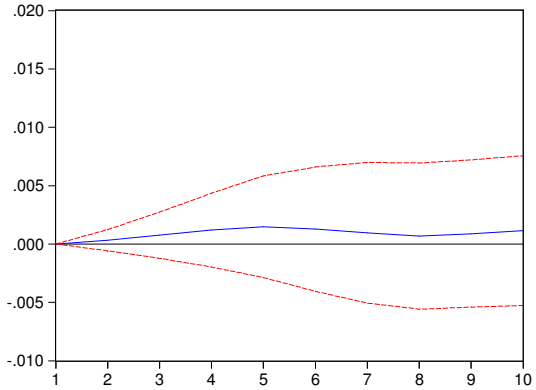
Inventories/Assets



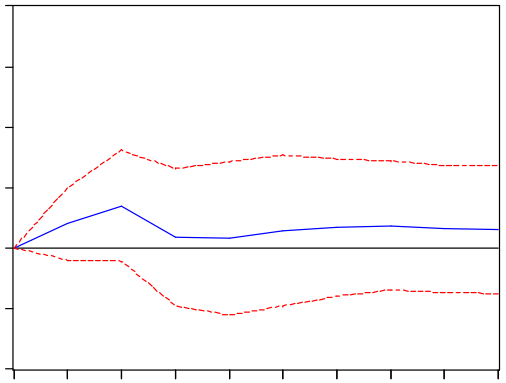
Inventories/Assets



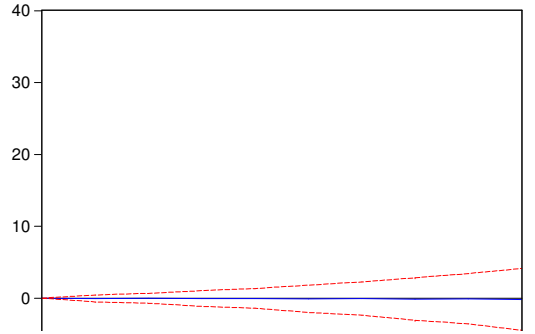
Net Operational Revenues/Assets



Net Operational Revenues/Assets



Long Term Debt/Assets



Long Term Debt/Assets

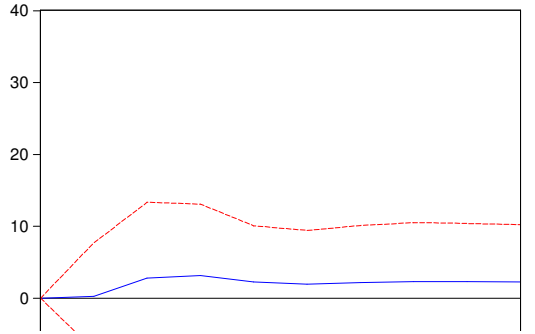


Table 4 – Effects of Monetary Contractions: System of Equations using Generalized Least Squares

System	Dependent Variable	Sum of Coefficients	
		Small	Large
System1	Net Operational Revenues/Assets	-0.56	0.12
		(0.04)	(0.61)
		(0.61)	(0.04)
	Inventories/Assets	-0.08	1.64
		(0.05)	(0.12)
		(0.04)	(0.15)
	Long Term Debt/Assets	-0.18	-0.73
		(0.08)	(0.35)
		(0.05)	(0.07)
	R2	0.73	0.41
	Durbin Watson	2.11	1.96
System2 (macroeconomic variables)	Net Operational Revenues/Assets	-0.42	-0.15
		(0.03)	(0.44)
		(0.01)	(0.73)
	Inventories/Assets	-0.43	0.61
		(0.04)	(0.08)
		(0.02)	(0.32)
	Long Term Debt/Assets	-0.81	0.62
		(0.05)	(0.41)
		(0.03)	(0.51)
	R2	0.21	0.79
	Durbin Watson	1.82	1.94
Sample		1994Q4 to 2005Q4	1994Q4 to 2005Q4

Panel A OLS Aggregate Data Inventories/Total Assets

Dependent Variable Equations	Growth Rate of Inventories/Assets (ΔInventories)			
	Small Firms		**Large Firms**	
	(1)	**(2)**	**(3)**	**(4)**
Constant	0.31 (0.26)	0.42 (0.21)	0.17 (0.43)	0.82 (0.54)
(Inventories/Assets)(-1)		-0.18 (0.04)		0.32 (0.09)
Balance sheet (-1)	0.30 (0.04)	0.22 (0.04)	-0.50 (0.41)	-0.77 (0.83)
Balance sheet (-2)	-0.37 (0.08)	0.14 (0.11)	-1.61 (0.21)	-0.23 (0.28)
Balance sheet (-3)	0.77 (0.44)	0.71 (0.12)	-2.00 (0.21)	0.16 (0.19)
Sum of Balance Sheet Coefficients Wald Test	0.70 (0.12)	1.07 (0.08)	-4.21 (0.52)	-2.23 (0.28)
Serial Autocorrelation - LM	(0.21)	(0.21)	(0.77)	(0.42)
Heterocedasticity-White (cross)	(0.0)	(0.12)	(0.82)	(0.31)
Adjusted R2	(0.87)	0.51	0.38	0.43
Sample	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q3 to 2005Q4

Panel B OLS Aggregate Data Long Term Debt/Total Assets

Dependent Variable Equations	Long Debt/Assets			
	Small Firms		**Large Firms**	
	(5)	**(6)**	**(7)**	**(8)**
Constant	-0.52 (0.32)	-0.61 (0.31)	-0.71 (0.63)	-0.41 (0.61)
Long Term Debt/Assets(-1)		-0.41 (0.62)		172 (0.52)
Balance sheet ratio (-1)	0.51 (0.04)	0.41 (0.07)	-0.53 (0.86)	-0.93 (0.81)
Balance sheet ratio (-2)	0.31 (0.23)	0.73 (0.44)	-0.49 (0.58)	-0.3 (0.52)
Balance sheet ratio (-3)	0.50 (0.08)	1.06 (0.08)	-0.31 (0.59)	-0.22 (0.61)
Sum of Balance Sheet coefficients Wald Test	1.32 (0.05)	2.20 (0.18)	-1.31 (0.82)	-1.44 (0.32)
Serial Autocorrelation - LM	(0.88)	(0.28)	(0.09)	(0.42)
Heterocedasticity-White (cross)	(0.06)	(0.04)	(0.56)	(0.51)
Adjusted R2	0.52	0.61	0.41	0.52
Sample	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q4 to 2005Q4

Panel C OLS Aggregate Data Net Operational Revenues/ Total Assets

Dependent Variable	Net Operational Revenues/Assets			
	Small Firms		**Large Firms**	
Equations	(9)	(10)	(11)	**(12)**
Constant	0.13 (0.21)	0.41 (0.55)	1.15 (0.15)	2.31 (0.16)
Net Operational Revenues/Assets)(-1)		0.16 (0.39)		-0.76 (0.13)
Balance sheet (-1)	0.15 (0.31)	0.72 (0.43)	-0.18 (0.09)	-0.41 (0.81)
Balance sheet (-2)	0.61 (0.08)	0.51 (0.01)	-0.18 (0.23)	-1.44 (0.02)
Balance sheet (-3)	0.46 (0.39)	0.77 (0.06)	-0.09 (0.98)	-2.00 (0.23)
Sum of Balance Sheet Coefficients Wald Test	1.22 (0.01)	2.00 (0.24)	-0.45 (0.35)	-2.00 (0.23)
Serial Autocorrelation - LM	(0.06)	(0.18)	(0.85)	(0.73)
Heterocedasticity-White (cross)	(0.32)	(0.19)	(0.52)	(0.91)
Adjusted R2	0.61	0.65	0.32	(0.51)
Sample	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q4 to 2005Q4	1994Q4 to 2005Q4

Panel A Dynamic Pannel Random Effects Quartely Data Inventories/Assets

Dependent Variable	Inventories/Assets		
	(1)	**(2)**	**(3)**
Constant	0.42 (0.02)	0.21 (0.03)	-0.18 (0.32)
Inventories/Assets(-1)	0.54 (0.61)	0.31 (0.18)	0.16 (0.43)
Balance sheet (-1)	0.15 (0.31)	0.12 (0.21)	0.21 (0.42)
Balance sheet(-2)	0.12 (0.13)	0.12 (0.08)	0.043 (0.067)
Balance Sheet(-3)	-0.098 (0.44)	-0.089 (0.43)	0.002 (0.03)
Fixed Assets/Assets(-1)	0.18 (0.11)	0.35 (0.18)	0.09 (0.06)
Small*shock	-0.41 (0.03)	-0.12 (0.08)	-0.022 (0.04)
ΔSELIC		-0.21 (0.06)	-1.54 (0.04)
BNDES			0.092 (0.06)
Sum of Balance Sheet Coefficients Wald Test	0.20 (0.04)	0.14 (0.21)	0.25 (0.37)
DW	1.85	1.45	3.32
J statistic	0.04	0.04	3.32
Partial F	39.87 (0.02)	30.89 (0.02)	41.24 (0.0)
Sample		1994Q4 2005Q4	

Panel B Dynamic Pannel Random Effects Quartely Data Long Term Debt/Total Assets

Dependent Variable	Long Term Debt/Assets		
	(4)	**(5)**	**(6)**
Constant	0.021 (0.02)	0.23 (0.13)	0.31 (0.12)
Long Term Debt/Assets(-1)	0.13 (0.72)	-3.47 (0.00)	-0.38 (0.14)
Balance sheet (-1)	0.41 (0.05)	-0.129 (0.18)	0.13 (0.07)
Balance sheet (-2)	0.32 (0.06)	0.28 (0.12)	0.029 (0.02)
Balance sheet (-3)	-0.04 (0.16)	-0.22 (0.13)	-0.11 (0.44)
Balance sheet (-4)	-0.082 (0.18)	0.042 (0.57)	-0.2 (0.67)
Fixed Assets/Assets(-1)	0.21 (0.03)	0.32 (0.03)	0.14 (0.05)
Small*shock	-0.42 (0.07)	-0.015 (0.04)	0.03 (0.86)
ΔSELIC		-0.21 (0.05)	-0.067 (0.03)
BNDES			0.31 (0.0)
Sum of Balance Sheet Coefficients	0.64 (0.0)	-0.03 (0.02)	-0.16 (0.22)
DW	1.65	1.94	2.31
J statistic	0.9	0.41	9.36
Partial F	28.96 (0.0)	44.89 (0.0)	52.02 (0.0)
Sample		1994Q4	

Panel C Dynamic Pannel Random Effects Quartely Data Net Operational Revenues/Total Assets

Dependent Variable	Growth Rate of Net Operational Revenue/Assets		
	(7)	(8)	(9)
Constant	0.52 (0.02)	-1.41 (0.04)	0.41 (0.04)
Net Operational Revenues/Assets(-1)	-0.61 (0.06)	15.42 (0.04)	-0.16 (0.04)
Balance sheet (-1)	0.031 (0.02)	-0.28 (0.04)	0.058 (0.13)
Balance sheet(-2)	0.041 (0.08)	-0.17 (0.03)	0.41 (0.12)
Balance sheet(-3)	-0.015 (0.04)	-0.0094 (0.05)	-0.56 (0.04)
Balance sheet (-4)	-0.13 (0.08)	0.32 (0.21)	0.017 (0.19)
Fixed Assets /Assets(-1)	0.05 (0.04)	0.42 (0.03)	-0.342 (0.00)
Small*shock	-0.18 (0.05)	-0.66 (0.04)	-0.21 (0.01)
ΔSELIC		-0.51 (0.08)	-0.05 (0.0)
BNDES*Small			0.41 (0.04)
Sum of Balance Sheet Coefficients	-0.088 (0.02)	-0.15 (0.02)	-0.08 (0.05)
DW	1.74	1.65	1.9
J statistic	0.64	0.12	1.53
Partial F	64.55 (0.03)	44.51 (0.0)	69.43 (0.03)

Panel Dynamic Panel Randon Effects Annual Information Inventories/Total Assets

Dependent Variable	Growth Rate of Inventories/Assets	
	(1)	**(2)**
Constant	0.42	2.83
	(0.25)	(0.04)
Balance sheet (-1)	0.74	0.48
	(0.06)	(0.34)
Fixed Assets/Assets(-1)	0.86	0.41
	(0.06)	(0.02)
Small*shock	-0.61	-0.31
	(0.02)	(0.02)
inventories/assets(-1)		-1.61
		(0.06)
DW	1.21	1.44
J statistic	0	0
Partial F	88.43	76.74
	(0.00)	(0.00)
Sample	1997Q4 2007Q4	1997Q4 2007Q4

Panel B Dynamic Pannel Random Effects Annual Information LongTerm Debt/Assets

Dependent Variable	Growth Rate of Inventories/Assets	
	(3)	**(4)**
Constant	1.62 (0.32)	7.53 (0.53)
Balance sheet (-1)	0.14 (0.04)	0.41 (0.23)
Fixed Assets/Assets(-1)	0.42 (0.06)	0.46 (0.03)
Small*shock	-1.72 (0.03)	-0.71 (0.03)
Long Term Debt/assets(-1)		-0.42 (0.02)
DW	1.61	3.08
J statistic	0	0
Partial F	56.43 (0.00)	94.89 (0.00)
Sample	1997Q4 2007Q4	1997Q4 to 2007Q4

Panel C Dynamic Randon Effects Annual Information Net Operational Revenues/Assets

Dependent Variable	Growth Rate of Inventories/Assets	
	(5)	**(6)**
Constant	0.21 (0.09)	1.22 -0.17
Balance sheet (-1)	0.42 (0.02)	0.12 -0.29
Fixed Assets/Assets(-1)	0.73 (0.08)	0.95 (0.22)
Small *shock	-0.42 (0.00)	-0.11 (0.09)
Net Operational Revenues /Assets(-1)		-0.45 (0.03)
DW	1.71	1.84
J statistic	0	0
Partial F	48.53 (0.00)	50.23 (0.00)
Sample	1997 2004	1997 2004

Conclusions

- Small firms are more sensitive to monetary contractions than large firms
  - BNDES
- Reason: Agency Costs for small firms is greater
    - External Finance Premium greater than internal
  - Brazil:
    - A more restricted capital market
    - High interest rates
    - Ineffective judiciary system