Monetary Policy and its real effects: loan-level evidence from Brazil on the bank lending-channel

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Outline

- Motivation
- Brazil
- Data and Identification strategy
- Results
- Conclusions

Motivation

- Monetary Policy affects firms and the real economy through several channels;
  - Financial frictions (stemming from information asymmetries) affect the costs for banks to both **borrow** and **lend funds** in light of changes in the short-term funds rate; (Bernanke and Gertler, 1995).
  - Firms' balance sheets, i.e. investment opportunities, net-worth , and collateral value (BGG, 1996). This directly decreases credit demand, but also increases agency costs for banks. More importantly, banks redirect lending to higher net-worth firms (Bernanke and Gertler, 1989);
  - Banks' balance sheets. **MP directly reduces reservable (insured) liabilities (Stein,1988),** and increases wholesale (non-reservable) liabilities, and related agency costs, particularly for low capitalized banks, but also to less liquid and small banks (Kashyap and Stein, 1995; 2000);

Motivation

- Microdata supports identification of overlapping channels of MP on outstanding loans;
  - Kashyap and Stein(2000) use bank-level data:
    - aggregate data do not support the identification of the bank balance sheet (lending) channel, because supply and demand for credit co-move with MP;
    - find that smaller and less liquid banks respond strongly to MP tightening;
    - more importantly, aggregated estimates are likely biased, because bank strength is time-varying;
  - What about firm-level data?
  - Khwaja and Mian(2008) introduce loan-level data and finds that **“better firms prefer better banks”;**
  - Since this, some loan-level studies focus on bank lending and risk-taking channel of MP, e.g. Jimenez et al.(2012), Jimenez et al. (2014) for identification. They report a strong capital channel in line with BGG

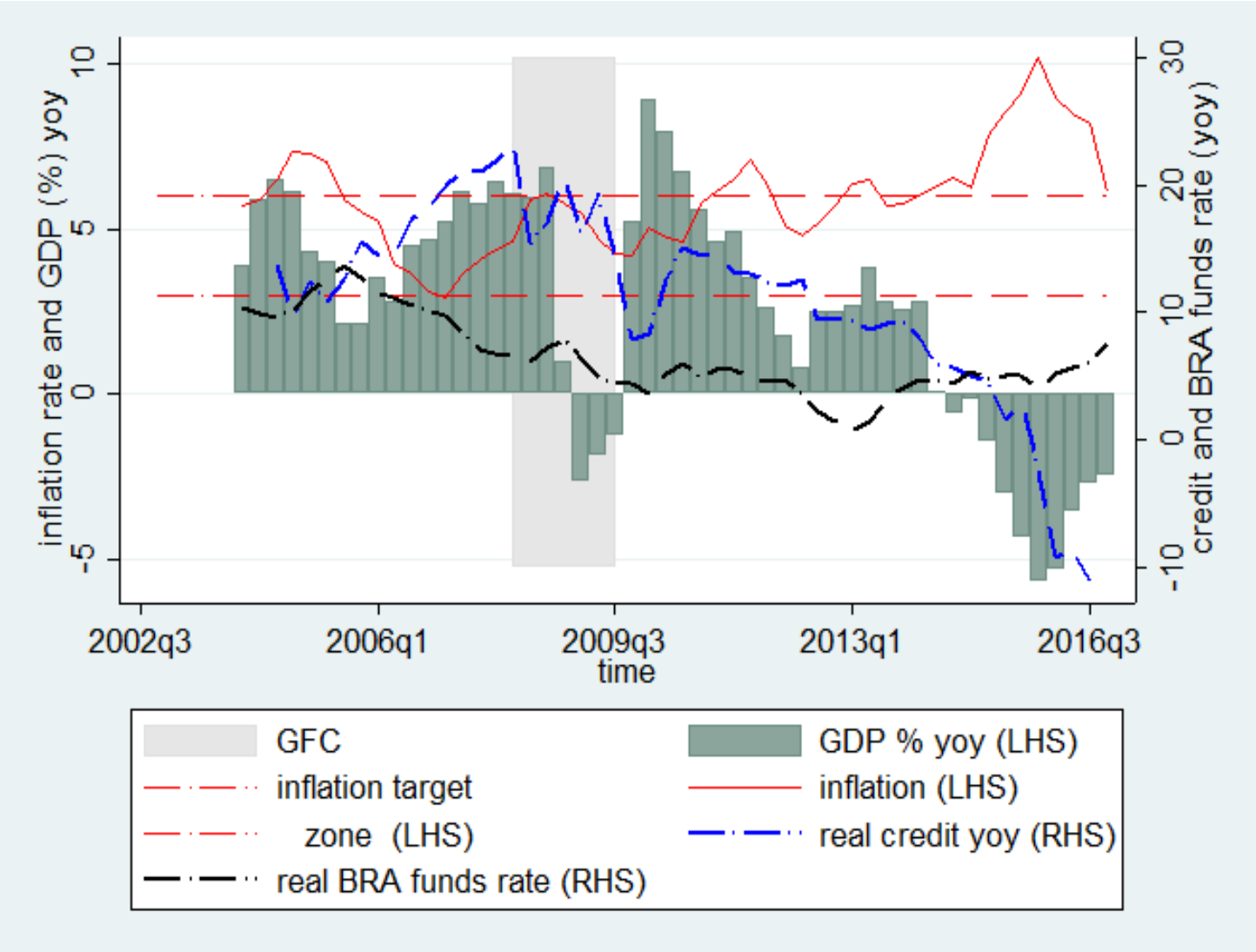
Motivation

- Some remaining issues;
  - What does firm*time FE really absorb?
  - firm-bank relationships are great for identification, but do not address the problem of quantifying the bank lending channel and its real effects and leave too many open questions for CBs;
    - What is the (unbiased) elasticity of MP in credit supply?
    - Does the bank lending channel has real effects for firms or the effects are just compositional?
    - Do Central Banks even need models with financial frictions and endogenous capital (e.g. Gerali et al.(2010))?
  - The more relevant studies focus on Spain where MP is arguably exogenous;
    - How Central Banks following a Taylor-rule can assess the bank lending channel?

Brazil

- Brazil is a financially open large EME adopting an inflation target regime since 1999;
- Between 2004 and 2016, Brazil has faced at least three business cycles. Including, the GFC and a deep recession in 2014 and 2016;
- Has experienced strong credit growth, greater than 10% (yoy) in real terms, between 2005 and 2011 (apart from the GFC year) and two episodes of credit crunch;

Brazil


inflation rate and GDP (%) yoy
-5
0
5
10
credit and BRA funds rate (yoy)
-10
0
10
20
30
2002q3
2006q1
2009q3
2013q1
2016q3
time
GFC
inflation target
zone (LHS)
real BRA funds rate (RHS)
GDP % yoy (LHS)
inflation (LHS)
real credit yoy (RHS)

Data and Identification Strategy

- Central Bank of Brazil has comprehensive high-quality microdata on credit and payments;
- Augmented with employment data from the Ministry of Labor and employment and bank-level data;
- I build a loan and a firm-level panel
- I focus on firms with multiple bank relationships (86%);
- Only credit in local currency (the “real”, BRL);
  - 0.5% of the sample is dropped

Data and Identification Strategy

- Over 40M bank*firm*time observations
- Close to 1,200M firms
- 52 quarters (2004Q1 to 2016Q4)
- 97 commercial banks
- 98 regions
- 76 sectors

Data and Identification Strategy

- Loan-level panel:

$$\Delta \log loans_{b,f,t} = capital_{b,t-1} * \Delta_{i,t-1} + bank_{b,t-1} + \alpha_{f,t} + e_{f,b,t}$$

$$\Delta \log loans_{b,f,t} = capital_{b,t-1} * \Delta_{i,t-1} + bank_{b,t-1} + \alpha_{f,t} + capital_{b,t-1} * [CPI_{t-1}, CPI^{*}_{t-1}, \Delta GDP_{t-1}] + bank_{b,t-1} * \Delta i_{t-1} + bank_{b,t-1} * [CPI_{t-1}, CPI^{*}_{t-1}, \Delta GDP_{t-1}] + e_{f,b,t}$$

Data and Identification Strategy

- Robustness I: The time subsamples

$$\Delta \log loans_{b,f,t} = capital_{b,t-1} * \Delta_{i,t-1} + bank_{b,t-1} + \alpha_{f,t} + capital_{b,t-1} * [CPI_{t-1}, CPI^{*}_{t-1}, \Delta GDP_{t-1}] + bank_{b,t-1} * \Delta i_{t-1} + bank_{b,t-1} * [CPI_{t-1}, CPI^{*}_{t-1}, \Delta GDP_{t-1}] + e_{f,b,t}$$

Data and Identification Strategy

- Robustness II: The Y vector of macro vars

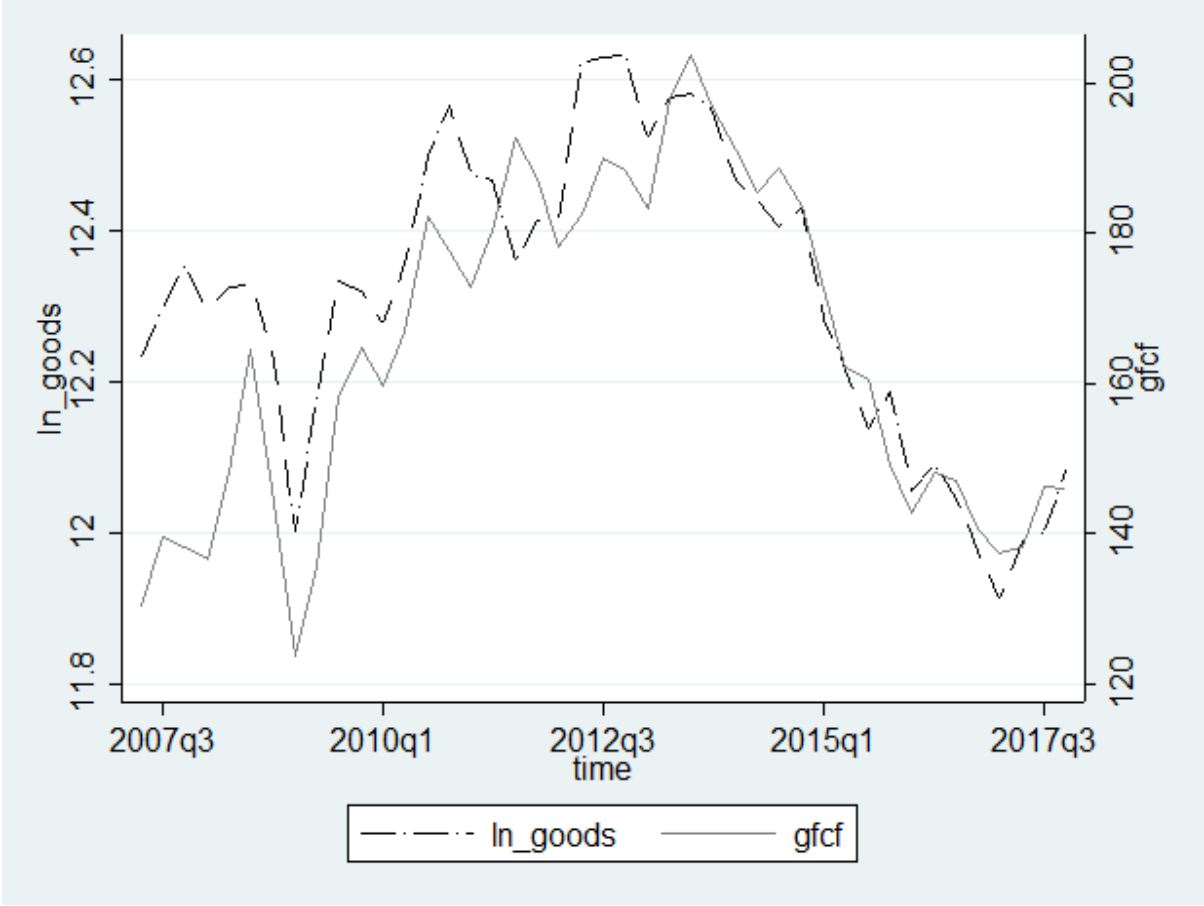
$$\Delta \log loans_{b,f,t} = capital_{b,t-1} * \Delta_{i,t-1} + bank_{b,t-1} + \alpha_{f,t} + capital_{b,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + bank_{b,t-1} * \Delta i_{t-1} + bank_{b,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + e_{f,b,t} + capital_{b,t-1} * \Delta Y_{t-1} + bank_{b,t-1} * \Delta Y_{t-1}$$

Data and Identification Strategy

- Firm-level panel and real-effects:
  - Where X is log loan, log number of employees, log gfcf

$$\Delta X_{f,t} = capital_{f,t-1} * \Delta_{i,t-1} + bank_{f,t-1} + capital_{f,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + bank_{f,t-1} * \Delta i_{t-1} + bank_{f,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + macro_{t-1} + d_s + firm_{f,t-1} + e_{f,t} + \alpha_{sector,region}$$

Data and Identification Strategy



Gross fixed capital formation (GFCF) from the national accounts and the investment proxy (i.e., the quarterly log transfers from all firms in the payment system to producers of capital and durable good). The correlation is 89.7%

Data and Identification Strategy

- Robustness III: Instrumenting Δi_{t-1} on Taylor(1993) residuals

$$\Delta \log \text{loans}_{b,f,t} = capital_{b,t-1} * \Delta_{i,t-1} + bank_{b,t-1} + \alpha_{f,t} + capital_{b,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + bank_{b,t-1} * \Delta i_{t-1} + bank_{b,t-1} * [CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}] + e_{f,b,t}$$

Results

Dependent: $\Delta\ln(\text{credit})_{b,f,t:t+1}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δi_{t-1}							
* $size_{t-1}$		0.034			0.106*	0.135***	0.129**
		(0.041)			(0.056)	(0.042)	(0.056)
* $capital_{t-1}$			0.010		0.028	0.035*	0.037*
			(0.013)		(0.018)	(0.018)	(0.020)
* $liquidity_{t-1}$				0.012	0.021**	0.018*	0.025**
				(0.010)	(0.011)	(0.011)	(0.012)
$size_{t-1}$	0.839***	0.847***	0.833***	0.869***	0.900***	0.900***	0.908***
	(0.292)	(0.293)	(0.292)	(0.289)	(0.291)	(0.273)	(0.284)
$capital_{t-1}$	0.216**	0.217**	0.219**	0.216**	0.225**	0.217**	0.205*
	(0.091)	(0.091)	(0.090)	(0.091)	(0.088)	(0.096)	(0.105)
$liquidity_{t-1}$	-0.046	-0.043	-0.047	-0.044	-0.039	-0.043	-0.054
	(0.041)	(0.042)	(0.042)	(0.041)	(0.043)	(0.039)	(0.052)
Observations	4,071,643	4,071,643	4,071,643	4,071,643	4,071,643	4,071,643	4,071,642
R-squared	0.408	0.408	0.408	0.408	0.408	0.409	0.018
Firm-Bank, Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm, Macro Controls	<>	<>	<>	<>	<>	<>	Yes
Firm*Time FE	Yes	Yes	Yes	Yes	Yes	Yes	No
$\{\Delta CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}\}$ * Bank $Controls_{t-1}$	No	No	No	No	No	Yes	Yes
$\{\Delta i_{t-1}\}$ * Bank $Controls_{t-1}$	No	No	No	No	Yes	Yes	Yes
Cluster	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter

Results

	$\Delta \ln(credit)_{b,f,t:t+1}$					
	(1)	(2)	(3)	(4)	(5)	dif (4) - (5)
	All quarters (2004Q1 - 2016Q4)	(-) BRA crisis downturn (2014Q2-2015Q4)	(-) GFC crisis quarters (2008Q3-2009Q3)	Pre - GFC quarters (2004Q1-2008Q2)	Post - GFC quarters (2016Q1-2016Q4)	
Δi_{t-1}						
* $size_{t-1}$	0.135***	0.146***	0.097**	0.128**	0.144*	-0.036
	(0.042)	(0.043)	(0.045)	(0.058)	(0.080)	(0.097)
* $capital_{t-1}$	0.035*	0.040**	0.036*	0.044**	0.086***	0.054
	(0.018)	(0.017)	(0.020)	(0.017)	(0.028)	(0.034)
* $liquidity_{t-1}$	0.018*	0.020*	0.021*	-0.002	0.052***	0.035*
	(0.011)	(0.011)	(0.012)	(0.008)	(0.019)	(0.018)
Observations	4,071,643	3,376,620	3,587,329	833,732	2,753,597	
R-squared	0.409	0.406	0.409	0.389	0.417	
Bank controls	Yes	Yes	Yes	Yes	Yes	
Firm-Bank Controls	Yes	Yes	Yes	Yes	Yes	
Firm*Time FE	Yes	Yes	Yes	Yes	Yes	
$\{\Delta CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes	
$\{\Delta i_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes	
Cluster	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	

Results

	(1)	(2)	(3)	(4)	(5)
Δi_{t-1} *					
$capital_{t-1}$	0.035*	0.042**	0.044***	0.046***	0.042**
	(0.018)	(0.016)	(0.016)	(0.015)	(0.016)
Δshort shadow $rate_{t-1}$ *					
$capital_{t-1}$		0.017			
		(0.037)			
ΔFED funds $rate_{t-1}$ *					
$capital_{t-1}$			-0.070		
			(0.072)		
Δcommodity $prices_{t-1}$ *					
$capital_{t-1}$				0.004	
				(0.004)	
global uncertainty$_{t-1}$*					
$capital_{t-1}$					0.003
					(0.006)
Observations	4,071,643	4,071,643	4,071,643	4,071,643	4,071,643
R-squared	0.409	0.409	0.409	0.409	0.409
Bank controls	Yes	Yes	Yes	Yes	Yes
Firm-Bank Controls	Yes	Yes	Yes	Yes	Yes
Firm*Time FE	Yes	Yes	Yes	Yes	Yes
{ΔCPI_{t-1}, CPI^*_{t-1}, ΔGDP_{t-1}} * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
{Δi_{t-1}} * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
{G global $variable_{t-1}$} * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
Cluster	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter	bank sector*quarter

Results

	(1)	(2)	(3)	(4)	(5)
Δi_{t-1} *					
$capital_{t-1}$	0.035*	0.041**	0.049***	0.035**	0.053***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.019)
Political Uncertainty (Brazil) $_{t-1}$ *					
$capital_{t-1}$		0.000			
		(0.001)			
ICU_{t-1} *					
$capital_{t-1}$			-0.047**		
			(0.021)		
ΔCurrent Accounts-to-GDP$_{t-1}$ *					
$capital_{t-1}$				-0.003**	
				(0.002)	
ΔDebt-to-GDP$_{t-1}$ *					
$capital_{t-1}$					0.032***
					(0.009)
Observations	4,071,643	4,071,643	4,071,643	4,071,643	4,071,643
R-squared	0.409	0.409	0.409	0.409	0.409
Bank controls	Yes	Yes	Yes	Yes	Yes
Firm-Bank Controls	Yes	Yes	Yes	Yes	Yes
Firm*Time FE	Yes	Yes	Yes	Yes	Yes
$\{\Delta CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
$\{\Delta i_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
{L Local $variable_{t-1}$} * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes
Cluster	bank	bank	bank	bank	bank
	sector*quarter	sector*quarter	sector*quarter	sector*quarter	sector*quarter

Results

	$\Delta\ln(\text{credit})_{f,t:t+1}$		$\Delta\ln(\text{n employees})_{f,t:t+1}$		$\Sigma\ln(\text{gfcf})_{f,t+1:t+1}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Δi_{t-1} *						
$size_{t-1}$	0.127**	0.007	0.117	0.007	0.117	0.138***
	(0.053)	(0.014)	(0.226)	(0.012)	(0.226)	(0.040)
$capital_{t-1}$	0.045***	0.038***	0.007*	0.007*	0.128***	0.038***
	(0.013)	(0.012)	(0.004)	(0.003)	(0.034)	(0.012)
$liquidity_{t-1}$	0.033***	0.018**	0.008***	0.008***	0.027	0.018**
	(0.011)	(0.008)	(0.002)	(0.002)	(0.046)	(0.008)
Δi_{t-1}	-0.195**		-0.092***		-0.003	
	(0.091)		(0.032)		(0.729)	
ΔGDP_{t-1}	0.110		-0.038		-0.260	
	(0.103)		(0.051)		(1.115)	
ΔCPI_{t-1}	0.083		-0.245***		-1.271	
	(0.156)		(0.077)		(1.720)	
CPI^*_{t-1}	-1.385**		0.192		2.051	
	(0.656)		(0.238)		(5.068)	
Observations	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353
R-squared	0.054	0.055	0.046	0.046	0.311	0.311
Macro controls and Seasonal dummies	Yes	<>	Yes	<>	Yes	<>
Time FE	No	Yes	No	Yes	No	Yes
Firm-Bank, Firm and Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
$\{\Delta CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$\{\Delta i_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	max bank sector*quarter	max bank sector*quarter	max bank sector*quarter	max bank sector*quarter	max bank sector*quarter	max bank sector*quarter

Results (Taylor(1993) residuals)

	(1) Δi_{t-1}	(2) Δi_{t-1}	(4) Δi_{t-1}	Baseline
ΔCPI_{t-1}	0.794*		0.857**	
	(0.411)		(0.404)	
Output Gap_{t-1}	0.426**	0.411**	0.286	
	(0.173)	(0.185)	(0.188)	
CPI^*_{t-1}		0.897	1.010*	
		(0.608)	(0.588)	
Observations	52	52	52	
R-squared	0.235	0.210	0.282	
Seasonal effects	Yes	Yes	Yes	
ε_{t-1} *				Δi_{t-1} *
* $size_{t-1}$	0.159***	0.157***	0.155***	0.135***
	(0.050)	(0.048)	(0.047)	(0.042)
* $capital_{t-1}$	0.048**	0.046**	0.045**	0.035*
	(0.021)	(0.021)	(0.020)	(0.018)
* $liquidity_{t-1}$	0.028**	0.029**	0.026**	0.018*
	(0.013)	(0.013)	(0.012)	(0.011)
Observations	4,071,643	4,071,643	4,071,643	4,071,643
R-squared	0.408	0.408	0.408	0.408
Firm-Bank Controls and Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes
Firm*Time FE	Yes	Yes	Yes	Yes
$\{\Delta CPI_{t-1}, CPI^*_{t-1}, \Delta GDP_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes
$\{\Delta i_{t-1}\}$ * Bank $Controls_{t-1}$	Yes	Yes	Yes	Yes

Results (Taylor(1993) residuals)

	$\Delta\ln(\text{credit})_{f,t:t+1}$	$\Delta\ln(\text{n employees})_{f,t:t+1}$	$\Sigma\ln(\text{gfcf})_{f,t+1:t+1}$	$\Delta\ln(\text{credit})_{f,t:t+1}$	$\Delta\ln(\text{n employees})_{f,t:t+1}$	$\Sigma\ln(\text{gfcf})_{f,t+1:t+1}$	$\Delta\ln(\text{credit})_{f,t:t+1}$	$\Delta\ln(\text{n employees})_{f,t:t+1}$	$\Sigma\ln(\text{gfcf})_{f,t+1:t+1}$
ε_{t-1}	**-0.125***	**-0.067***	**0.157**	**-0.127***	**-0.068***	**0.159**	**-0.141***	**-0.075****	**0.122**
	(0.072)	(0.034)	(0.817)	(0.071)	(0.034)	(0.813)	(0.072)	(0.034)	(0.789)
* size_{t-1}	0.164***	0.015	0.142	0.168***	0.014	0.146	0.155**	0.014	0.153
	(0.060)	(0.013)	(0.241)	(0.061)	(0.014)	(0.237)	(0.060)	(0.014)	(0.233)
* capital_{t-1}	0.053***	0.009**	0.135***	0.054***	0.008**	0.130***	0.051***	0.008**	0.134***
	(0.015)	(0.003)	(0.043)	(0.016)	(0.004)	(0.041)	(0.015)	(0.004)	(0.040)
* liquidity_{t-1}	0.036***	0.008***	0.023	0.038***	0.007***	0.022	0.035***	0.008***	0.024
	(0.011)	(0.002)	(0.051)	(0.011)	(0.002)	(0.050)	(0.011)	(0.002)	(0.050)
Observations	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353	1,611,353
R-squared	0.065	0.046	0.311	0.065	0.046	0.311	0.065	0.046	0.311
Seasonal effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls and Seasonal dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No
Firm-Bank, Firm and Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\{\Delta\text{CPI}_{t-1}, \text{CPI*}_{t-1}, \Delta\text{GDP}_{t-1}\}$ * Bank Controls_{t-1}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\{\Delta i_{t-1}\}$ * Bank Controls_{t-1}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	max bank sector*quarter								

Conclusions

- I find evidence of a bank lending channel, economically and statistically significant operating in the spirit of Kashyap and Stein (2000) and Jimenez et al. (2012);
- I find that firms do not “crowd out” resorting to “stronger banks”. Moreover, the capital channel has real effects for firms including on investment and employment;
- I find results slightly economically stronger while instrumenting MP on Taylor residuals;
- I find that such results are not driven by possibly correlated global factors or by any particular time span. Some local factors may interfere in the transmission channel.