Credit Cycles, Credit Risk and Countercyclical Loan Provisions

M. López[1], F. Tenjo[2] and H. Zárate[3]

Banco de la República[1,3] and CEMLA[2]

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Outline

Facts

- Deep credit cycles are frequently symptoms of macroeconomic turbulence.
- These come hand-in-hand with swings in asset prices and strong movements in investment and output (BGG ,1999 and Kiyotaki and Moore, 1997).
- The Great Recession in the late 2000s :
  - Increased competition among banks, originated in the deregulation of the US banking sector in the 1970s and 1980s, resulted in a financial system where banks were increasingly required to keep pace with the returns on equity offered by their rivals leading to increased risk taking.

Responses

- Scholars and policy makers have increased their atention about regulation, competition and risk taking.
- Some of the responses have addressed the relevance of using macroprudential tools to rein in credit excesses.
- Some tools like countercyclical capital buffers help:
  - First, to mitigate credit crunches because they provide additional buffers in downturns.
  - Second, higher requirements on bank own funds can cool credit-led booms (Jimenez et al. 2012)

Goals

- First, we present micro-econometric evidence of the positive relationship between rapid credit growth and deterioration in lending portfolios in Colombia.
- In this sense, this paper constitutes the first study based on loan-to-loan information for Colombia.
- Second, given their importance for macroprudential policy, we evaluate the effectiveness of the implementation of the countercyclical loan provisions in Colombia in terms of smoothing the credit cycle.
- We implement a matching technique that allows us to have a homogeneous database to be used later on in our econometric analysis.

The data

- We focus in an individual loan level analysis to draw conclusion regarding the relationship between rapid credit growth and credit risk.
- The database we use in our study is recorded by banks and reported to the Superfinanciera.
- The database consists of over two million commercial loans whose amount represents near 70 percent of the total amount of loans granted by banks in Colombia.
- The period analyzed: 2003.1-2011.2.

Probit Model

- Saurina and Jimenez (2006): The equation to be estimated relates the PD at an individual loan level and its relation to the cyclical position of the bank credit policy:

$$Pr(DEFAULT_{blt+k}=1) = F(\theta+\alpha(LOANG_{bt}-averageLOANG_b)+\beta \mid LOANG_{bt}- averageLOANG_b \mid +\chi LOANCHAR_{lt}+\delta_1 BANKCHAR_{bt}+ \delta_2 BORROWERCHAR_{ft}+\varphi_t+\eta_i \quad (1)$$

where the probability of default of loan l, in bank b, some k years after being granted (i.e., at $t+2$, $t+3$, and $t+4$) is a logistic function of the current lending position of each bank in comparison to its average loan growth, $(LOANG_{bt}-averageLOANG_b)$,

- If the coefficient α is positive it means that during booms the credit risk increases. This could be related to low credit standards during booms.
- Test for the asymmetries in this relationship in each phase of the credit cycle.

Results

Table : Estimations Results of Equation (1): Part A.

Variables	(1) Coeff.	Sig.	(2) Coeff.	Sig.
Dependent Variable	$DEFAULT_{ijt+2}$ *(0/1)*		$DEFAULT_{ijt+2}$ *(0/1)*	
$LOANG_{bt}$-AVERAGE $LOANG_b(\alpha)$	0.00012	***	-0.00014	***
$\lvert LOANG_{bt} - AVERAGELOANG_b \rvert(\beta)$	-	-	0.00040	***
$BANK\ SIZE_{b,t}$	0.23757	***	0.26126	***
OWN FOUNDS/TOTAL $ASSETS_{b,t}$	4.92541	***	4.84037	***
$NPL_{b,t}$-NPL_t	0.17542	***	0.16914	***
$BORROWER\ RISK_{f,t}$	1.99213	***	1.99146	***
$LN(2+AGE\ AS\ BORROWER)_{f,t}$	-0.04336	***	-0.04351	***
$LN(1+NUMBER\ OF\ BANK\ RELATIONSHIPS)_{f,t}$	0.19450	***	0.19597	***
$COLLATERAL_{l,t}$ (0/1)	-0.55900	***	-0.55724	***
$LN(SIZE\ OF\ THE\ LOAN_{l,t})$	-0.06496	***	-0.06519	***
$MATURITY_l$ 1Y-3Y (0/1)	0.01435	***	0.01381	***
$MATURITY_l$ 3Y-MORE (0/1)	-0.34199	***	-0.34087	***
$INTEREST\ RATE_t$	0.05983	***	0.06053	***
$GDPG_t$	-1.99237	***	-1.97802	***
T	0.00704	***	0.00703	***
CONSTANT	-0.188954438	***	-0.213215756	***
-LOGLIKELIHOOD	-152644.2049	***	-152632.8964	***
Test Asymmetric Impact				
(p-value)				
$\alpha+\beta=0$	-		$<.0001$	
$\alpha-\beta=0$	-		0.0004	

Results

Table : Estimations Results of Equation (1): Part B.

Variables	(3)		(4)	
	Coeff.	Sig.	Coeff.	Sig.
Dependent Variable	$DEFAULT_{ijt+3}$ *(0/1)*		$DEFAULT_{ijt+3}$ *(0/1)*	
$LOANG_{bt}$-AVERAGE $LOANG_b(\alpha)$	0.00016	***	0.00021	***
$\lvert LOANG_{bt} - AVERAGELOANG_b \rvert(\beta)$	-	-	-0.00006	***
$BANK\ SIZE_{b,t}$	0.64153	***	0.64923	***
$OWN\ FOUNDS/TOTAL\ ASSETS_{b,t}$	2.50416	***	2.45405	***
$NPL_{b,t}$-NPL_t	-0.16485	***	-0.16150	***
$BORROWER\ RISK_{f,t}$	2.08732	***	2.10175	***
$LN(2+AGE\ AS\ BORROWER)_{f,t}$	-0.03206	***	-0.03321	***
$LN(1+NUMBER\ OF\ BANK\ RELATIONSHIPS)_{f,t}$	0.17973	***	0.18186	***
$COLLATERAL_{l,t}$ (0/1)	-0.51065	***	-0.51543	***
$LN(SIZE\ OF\ THE\ LOAN_{l,t})$	-0.08491	***	-0.08501	***
$MATURITY_l$ 1Y-3Y (0/1)	0.25552	***	0.25416	***
$MATURITY_l$ 3Y-MORE (0/1)	-0.28924	***	-0.28478	***
$INTEREST\ RATE_t$	0.02257	***	0.02278	***
$GDPG_t$	-0.42148	***	-0.38363	***
T	0.02244	***	0.02317	***
CONSTANT	0.046005914	***	0.047419299	***
-LOG LIKELIHOOD	-84335.95906	***	-83417.41346	***
Test Asymmetric Impact				
(p-value)				
$\alpha+\beta=0$	-		0.2409	
$\alpha-\beta=0$	-		0.3768	

Results

Table : Estimations Results of Equation (1): Part C.

Variables	(5)		(6)	
	Coeff.	Sig.	Coeff.	Sig.
Dependent Variable	$DEFAULT_{ijt+4}$ *(0/1)*		$DEFAULT_{ijt+4}$ *(0/1)*	
$LOANG_{bt}$-AVERAGE $LOANG_b(\alpha)$	0.00046 ***	***	0.00006	***
$\lvert LOANG_{bt} - AVERAGELOANG_b \rvert(\beta)$	-	-	-0.00070	***
$BANK\ SIZE_{b,t}$	1.29230	***	1.33032	***
$OWN\ FOUNDS/TOTAL\ ASSETS_{b,t}$	4.03234	***	4.88155	***
$NPL_{b,t}$-NPL_t	-0.16069	***	-0.07872	***
$BORROWER\ RISK_{f,t}$	1.94020	***	1.90044	***
$LN(2+AGE\ AS\ BORROWER)_{f,t}$	-0.05088	***	-0.06173	***
$LN(1+NUMBER\ OF\ BANK\ RELATIONSHIPS)_{f,t}$	0.13677	***	0.13413	***
$COLLATERAL_{l,t}$ (0/1)	-0.57640	***	-0.58958	***
$LN(SIZE\ OF\ THE\ LOAN_{l,t})$	-0.08019	***	-0.07475	***
$MATURITY_l$ 1Y-3Y (0/1)	0.04244	***	0.07358	***
$MATURITY_l$ 3Y-MORE (0/1)	-0.48453	***	-0.56795	***
$INTEREST\ RATE_t$	-0.01308	***	0.00206	***
$GDPG_t$	2.41658	***	1.18897	***
T	0.01392	***	0.01020	***
CONSTANT	0.148602112	***	0.21297513	***
-LOG LIKELIHOOD	-41431.50171	***	-48544.15863	***
Test Asymmetric Impact				
(p-value)				
$\alpha+\beta=0$	-		$<.0001$	
$\alpha-\beta=0$	-		0.0248	

Results

Table : Estimations Results of Equation (1): (Loan Growth Rate of Bank Introduced without Comparison to Its Average Value)

Variables	(1)		(2)		(3)	
	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.
Dependent Variable	$DEFAULT_{ijt+2}$ *(0/1)*		$DEFAULT_{ijt+3}$ *(0/1)*		$DEFAULT_{ijt+4}$ *(0/1)*	
$LOANG_{bt}$	0.00019	***	0.00021	***	-0.00041	***
BANK $SIZE_{b,t}$	0.24276	***	0.65198	***	1.41945	***
OWN FUNDS/TOTAL $ASSETS_{b,t}$	4.87076	***	2.49528	***	4.87747	***
$NPL_{b,t}$-NPL_t	0.17324	***	-0.16762	***	-0.07814	***
BORROWER $RISK_{f,t}$	1.99169	***	2.08752	***	1.89513	***
LN(2+AGE AS BORROWER)$_{f,t}$	-0.04335	***	-0.03194	***	-0.06141	***
LN(1+NUMBER OF BANK RELATIONSHIPS)$_{f,t}$	0.19419	***	0.17945	***	0.13671	***
$COLLATERAL_{l,t}$ (0/1)	-0.55819	***	-0.51004	***	-0.58765	***
LN(SIZE OF THE $LOAN_{l,t}$)	-0.06496	***	-0.08496	***	-0.07472	***
$MATURITY_l$ 1Y-3Y (0/1)	0.01362	***	0.25552	***	0.07282	***
$MATURITY_l$ 3Y-MORE (0/1)	-0.34167	***	-0.28884	***	-0.56704	***
INTEREST $RATE_t$	0.06036	***	0.02276	***	0.00466	***
$GDPG_t$	-2.01997	***	-0.44690	***	1.01642	***
T	0.00711	***	0.02247	***	0.00880	***
CONSTANT	-0.195886775	***	0.040082082	***	0.17267998	***
-LOG LIKELIHOOD	-152636.5752	***	-84334.14388	***	-48550.91107	***

Results

- The semi-elasticity of the credit growth is 0.73 percent for default in $t+2$
- Which means that the if a bank grows 1 percentage point, then the likelihood of default in $t+2$ is increased by 0.73 percent.
- Thus the economic impact is important.

Countercyclical Loan Provisions in Colombia

- As pointed out by Jimenez et. al (2012):
  "Among macroprudential instruments, the ones that have attracted most interest are countercyclical tools".
- Concerned about financial stability issues, the Superfinanciera introduced a countercyclical component to the individual provisions since July 2007.
- This component corresponds to the part of individual provision that is accrued in an additional form for each borrower during good times.
- The regulator, using historical data calculates two risk scenarios, A and B (B is the riskier scenario)
- The output of this calculations are two default probability matrixes which contain default probabilities for every type of credit and borrower.

Countercyclical Loan Provisions in Colombia

- Provisions, based on expected losses: $P = OVL * PD * LGD$
- The countercyclical provisioning system is a rule based system
- Each financial institution must accumulate or deplete its countercyclical provisions according to four criteria:
  - Deterioration of portfolio: $\Delta Provisions \geq 9\%$
  - Efficiency: $(PNR/IxI) \geq 17\%$
  - Fragility: $0 \leq PNR/GFM) \geq 42\%$
  - Loan growth: $\Delta CB < 23\%$

Countercyclical Loan Provisions in Colombia

- Default situation: if any of the four indicators is not met, the entity will be subject to accumulation of anticyclical provisions (upturn).
- If the four indicators are met 3 consecutive months, the entity will enter the depletion phase (downturn).

Counterfactual model

- Our goal in this section is to assess the causal effect of countercyclical provisions by means of a counterfactual model.
- In this model, we use the set of characteristics of the loans that were granted after the intervention, July 2007, and use them to obtain a set of loans granted before the intervention with "exactly" the same characteristics.

The propensity score

- This is done by computing a propensity score for each loan.
- A propensity score is a probability value that provides information about the likelihood that an unit has received treatment given a set of covariates.
- This conditional probability is predicted by a probit model.

The propensity score

- In a random database, for the period 2003.1-2011.2, the propensity score will give us the probability
  - that a loan will be assigned to a control group (group without countercyclical provisions)
  - or to a treatment group (group with countercyclical provisions).
- Then, using the propensity score, we match the loans in the control group with those in the treatment group.
- The resulting matched credits make up a set that reflects a synthetic situation in which there is a loan market of exactly the same characteristics before and after 2007.

Causal effect

- At this stage, we are able to assess the causal effect of the countercyclical provisions on loan growth using as econometric specification the equation:

$$LLoanA_{q,l,t} = \alpha + \beta * Treatment + Treatment * Characteristics_{q,l,t} + e_{q,l,t} \quad (2)$$

$LLoanA_{q,l,t}$ is the natural log of the amount of the loan in the q-percentile; *Treat* indicates if the credit was granted during the period 2007.3 and 2011.2; $Characteristics_{q,l,t}$: bank characteristics and $e_{q,l,t}$ is the error term.

Results on effectiveness

Table : Countercyclical provisions effect on the amount of the loans: Counterfactual distribution

Without interaction

Effect	q_5 **Coeff.**	q_{10} **Coeff.**	q_{25} **Coeff.**	q_{50} **Coeff.**	q_{75} **Coeff.**	q_{90} **Coeff.**	q_{95} **Coeff.**
Dependent variable:	$LLoanA_{q,l,t}$						
TREATMENT	-10.91 ***	-9.45 ***	-6.96 ***	-6.25 ***	-6.22 ***	-6.93 ***	-8.18 ***
CONSTANT	14.72 ***	15.62 ***	16.95 ***	18.13 ***	19.37 ***	20.93 ***	22.18 ***

Results on effectiveness

Interaction: Bank Size

Effect	q_5 **Coeff.**	q_{10} **Coeff.**	q_{25} **Coeff.**	q_{50} **Coeff.**	q_{75} **Coeff.**	q_{90} **Coeff.**	q_{95} **Coeff.**
Dependent variable:	$LLoanA_{q,l,t}$						
TREATMENT	-15.65 ***	-11.68 ***	-7.91 ***	-6.75 ***	-6.62 ***	-6.93 ***	-8.18 ***
Interaction							
BANK SIZE	0.32 ***	0.17 ***	0.77 ***	0.39 ***	0.31 ***	0.00	0.00
CONSTANT	14.72 ***	15.62 ***	16.95 ***	18.13 ***	19.37 ***	20.93 ***	22.18 ***

Results on effectiveness

Interaction: Own Funds

Effect	q_5 **Coeff.**	q_{10} **Coeff.**	q_{25} **Coeff.**	q_{50} **Coeff.**	q_{75} **Coeff.**	q_{90} **Coeff.**	q_{95} **Coeff.**
Dependent variable:	$LLoanA_{q,l,t}$						
TREATMENT	-11.83 ***	-8.80 ***	-6.99 ***	-6.09 ***	-5.91 ***	-6.93 ***	-8.18 ***
Interaction							
OWN FUNDS	0.22	-0.19	0.10	-0.49	-0.89 **	-0.00	-0.00
CONSTANT	14.72 ***	15.62 ***	16.95 ***	18.13 ***	19.37 ***	20.93 ***	22.18 ***

Results on effectiveness.

Interaction: Bank-NPL

Effect	q_5 **Coeff.**	q_{10} **Coeff.**	q_{25} **Coeff.**	q_{50} **Coeff.**	q_{75} **Coeff.**	q_{90} **Coeff.**	q_{95} **Coeff.**
Dependent variable:	$LLoanA_{q,l,t}$						
TREATMENT	-11.66 ***	-8.06 ***	-8.12 ***	-7.14 ***	-6.57 ***	-6.96 ***	-8.24 ***
Interaction							
BANK-NPL	-0.27	0.11	-0.10 *	-0.75 **	-3.19	-0.00	0.00
CONSTANT	14.77 ***	15.69 ***	16.99 ***	18.19 ***	19.42 ***	20.96 ***	22.24 ***

Summary

- We contributed to the empirical literature by presenting empirical evidence about the close relationship between rapid credit growth and ex ante credit risk in the Colombian economy.
- In the evaluation of the performance of a macropudential tool, countercyclical provisions, we showed that the use of this instrument helps to mitigate the credit cycle in Colombia.
- In this sense, it is important to keep in mind that the use of the interest rate to cool down credit growth might have very important collateral effects and that the use of macroprudential instruments maigh be an alternative or complement.