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Macroprudential policy evaluation using credit registry data: Argentina, 2009 - 2014

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“The impact of Macroprudential Policies and their interaction with
monetary policy: an empirical analysis using credit registry data.”

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- Motivation
- Describe credit registry data in Argentina
 - Information gathering and data
 - Financial system and debtors
- Overview of Macroprudential policy (MPP) in Argentina
- MPP and credit registry data: our sample
- Econometric approach and results
- Conclusions & Next steps



- Macroprudential policy (MPP) is concerned with **systemic repercussions of the financial institutions' behavior**
- **Impact evaluation has both macroeconomic and microeconomic dimensions**
- But there is more work on the former than on the latter
- Contrast with other policy areas –**impact evaluation based on more granular data**
- **Emerging market economies** have been **MPP pioneers** (financial crises track record)
- They are a **natural starting place for studies** on MPP effectiveness: wider variety of measures and in place for a longer period of time than in advanced economies.



- Argentina is no exception to the rule –experience with risk taking and policy design worthwhile more generally
- We use data from BCRA credit registry; focus on credit to companies and examine how growth at the financial institution-firm relationship level was affected after the introduction and tightening of two MPP instruments: a capital buffer and a limit on the net foreign exchange position of financial institutions.



- Change in credit associated to the introduction of MPP measures may not necessarily be the proper metric to assess their effectiveness, if they aim at strengthening the financial system.
- Financial system busts are systematically associated to previous credit booms (rationale for prudential policies that consider variables like the "credit gap"); but reducing credit growth during booms is an intermediate rather than a final target; and the ultimate objective of macro prudential policy is increasing financial system resilience against shocks from the economy, while also limiting negative spillover from the system to the economy at large.



- Arguably, both the intermediate and the final target are consistent in advanced economies, but the point is certainly weaker in financially underdeveloped economies. In the latter, with high potential for credit growth in the medium to long term, reducing the credit gap may hinder financial development and not contribute to strengthening the financial system.
- The aim of our exercise is literally to assess the impact of some macroprudential measures on credit growth at the individual bank-firm level, which is not necessarily identical to the effectiveness of macroprudential policy.

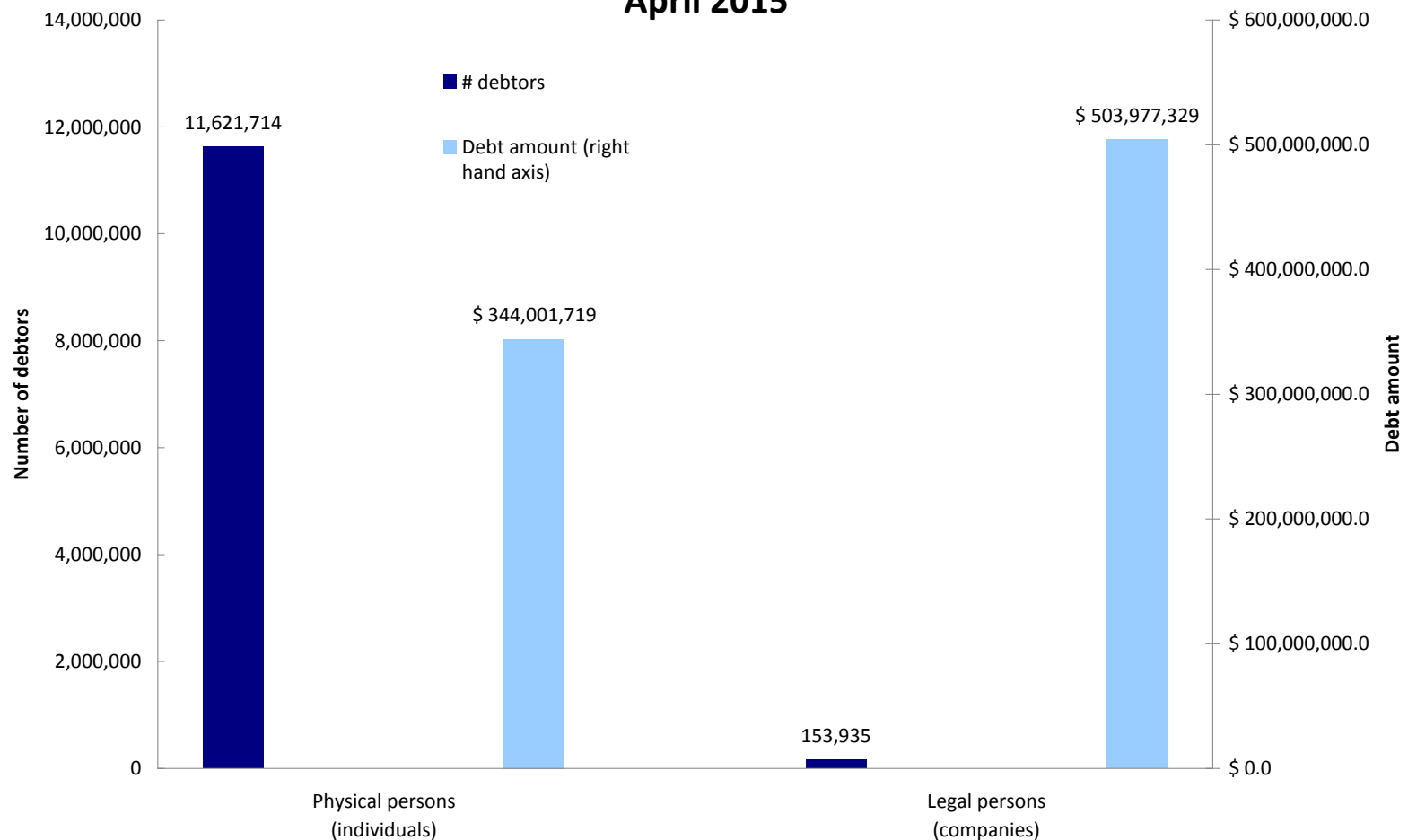


- *Central de deudores*: financial institutions under BCRA regulation and supervision inform **monthly outstanding credit balances** of their debtors since 1996.
- Informing institutions: banks (public, private –domestic, foreign and branches-), non-banking financial institutions (domestic and foreign), credit companies (*Cajas de Crédito*).
- Information provided by financial institutions includes:
 - **Debtor identification** (physical or law person, residency, private or public sector, main economic activity, SME, commercial or consumption debtor)
 - **Credit**: amount, type (overdraft, discount, promisory note, pledge, mortgage, personal, credit card, others), situation (performing/non-performing), guarantees, provision, interest rate, maturity.
 - Individual debtor information for balances over AR\$500 (USD 52 at the time of the exercise)



There are currently **11.8 million debtors** of the financial system, **150.000** of which are **companies**; total debt is AR\$800 billion (USD 86bn)

Financial system's debtors and debt amounts April 2015





Debtor and debt amount distribution: families and companies

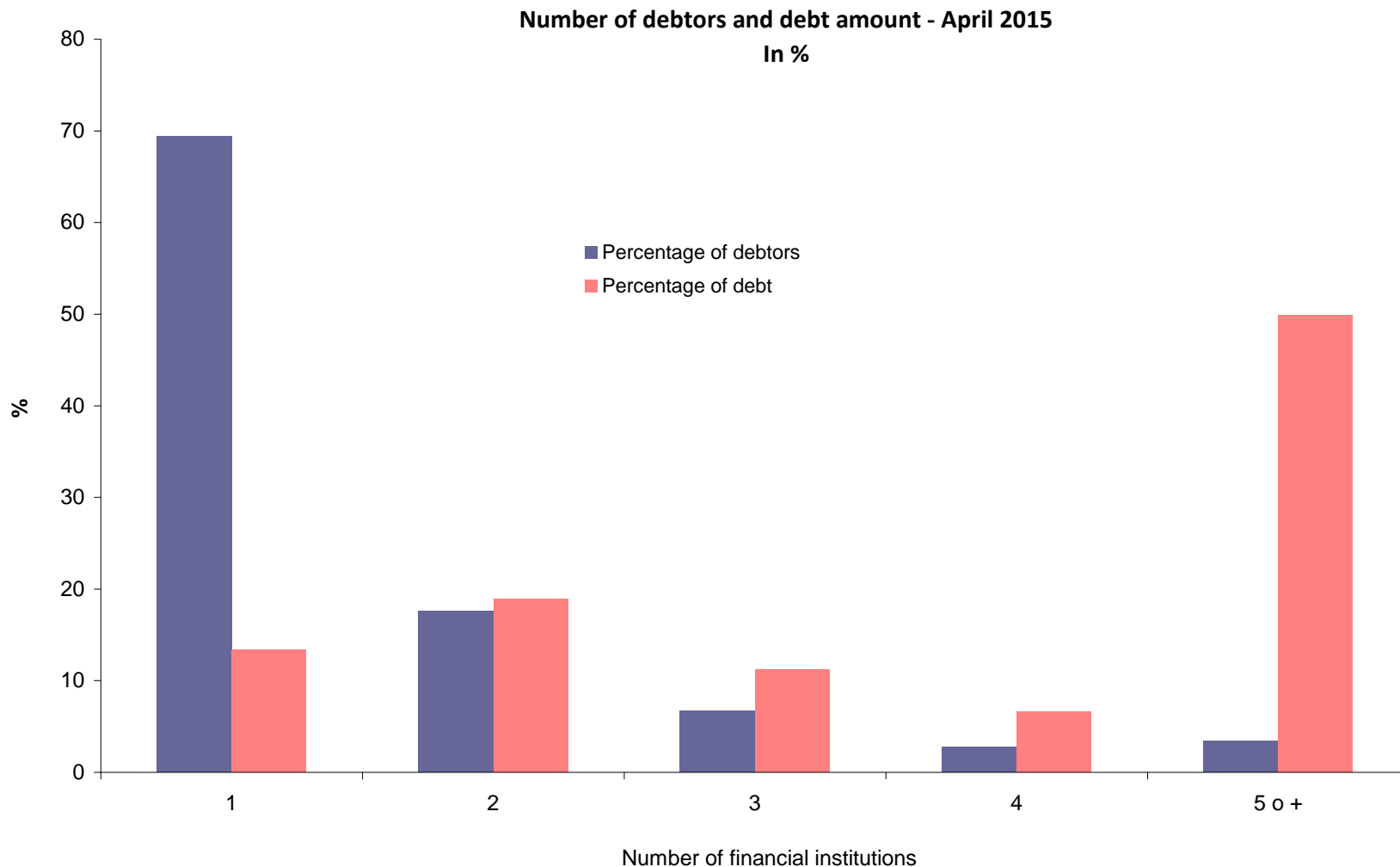
Buble size: debt amount





Most of **corporate debtors** also receive loans by one FI, but **most of debt granted to companies** is to those that work with 5 or more FIs

Debt held by companies and number of financial institutions





Selected features

- Managed floating exchange rate regime and international reserve accumulation
- Capital flows regulation
- **Ruling out currency mismatches**
- **Building up a capital buffer through profit reinvestment mechanism**
- Other instruments
 - Liquidity requirements
 - Deposit insurance



Ruling out currency mismatches

- Part of market risk capital requirement is based on foreign exchange volatility,
- Foreign currency lending capacity

Only firms whose revenues are denominated in foreign currency (or denominated in local currency but closely linked to the evolution of the exchange rate) such as those that export their production or substitute imports can obtain financing in foreign currency. In place since 2002/03, it has not been substantially changed.



Ruling out currency mismatches

- Foreign currency net global position

This regulation **sets a limit on financial institution net position in foreign currency**. Assets and liabilities from financial intermediation, bonds in foreign currency and forwards are included in the net global position. Introduced in 2003 (30% of Tier 1 capital), suspended in 2005, and **re-introduced in 2014 at 30%** of Tier 1 capital (February), **lowered to 20% in September**.



Capital buffer and profit reinvestment

- Any financial institution having profits to be distributed – after applying regulatory and supervisory filters – may allocate them through dividends as long as its regulatory capital – after dividends are paid – was at least 50% (75%) above the regulatory minimum capital requirement.
- This mechanism generates a capital buffer; its design is not necessarily countercyclical (even if it may have cyclical properties, as profits change with the cycle).
- Limits on dividend distribution and the capital conservation buffer are actually part of the same MP measure, the way it was implemented.
- Introduced in 2010 (50%), increased in 2012 (75%).



Reserve (liquidity) requirements.

- This measure is not explicitly countercyclical, but it has MP properties. Liquidity requirements have changed over time, not always with cyclical aims: changes in recent years tend to foster credit to SMEs and in relative underdeveloped regions, by reducing requirements to banks who grant such credits.

LTV / DTI ratios.

- There is a DTI ratio on retail credit to physical persons. There are LTV ratios for mortgages (previously, for pledges) that affect credit to companies.



- We aim to assess the effects on credit to companies of the capital buffer (II-2010; DBK1 and tightening I-2012 DBK2) and the most recent changes in foreign currency net global position (I-2014;PGN1 and tightening III-2014 PGN2), using credit registry data.
- It can be argued that other elements of the MPP package are important, but evaluating them would imply increasing sample size out of workable limits, and including performance of FIs during the financial crisis of 2001-2002.
- Both measures were introduced for reasons directly unrelated to credit growth (exogeneity).



- DBK was initially put in place in a context of external financial turbulence (with the first round of repercussions on EMEs of the Greek debt crisis); its tightening in 2012 was explicitly attributed to the aim of reinforcing FI solvency in line with the discussion of new international standards such as the capital conservation buffer.
- As for PGN, the suspension of limits in 2005 was decided in the face of foreign inflows, and allowed FI to buy foreign currency more aggressively. The re-introduction and tightening in 2014 occurred do to pressure on the local foreign exchange market, and one of its aims was to increase locally the supply of foreign currency.



- We use quarterly data from *Central de Deudores* from **QI – 2009 to QIV – 2014**.
- We look at credit to **law persons** (“companies”) in order to keep sample size in check: **150.000 companies** vs. over 10 M individuals, each quarter for **24 quarters**.
- Each observation in the sample is the total credit granted by a financial institution to a company: the amount associated to the pair (company i , FI j) in each quarter is the average of three monthly observations.
- This still leaves us with... over 5 M observations in the total sample

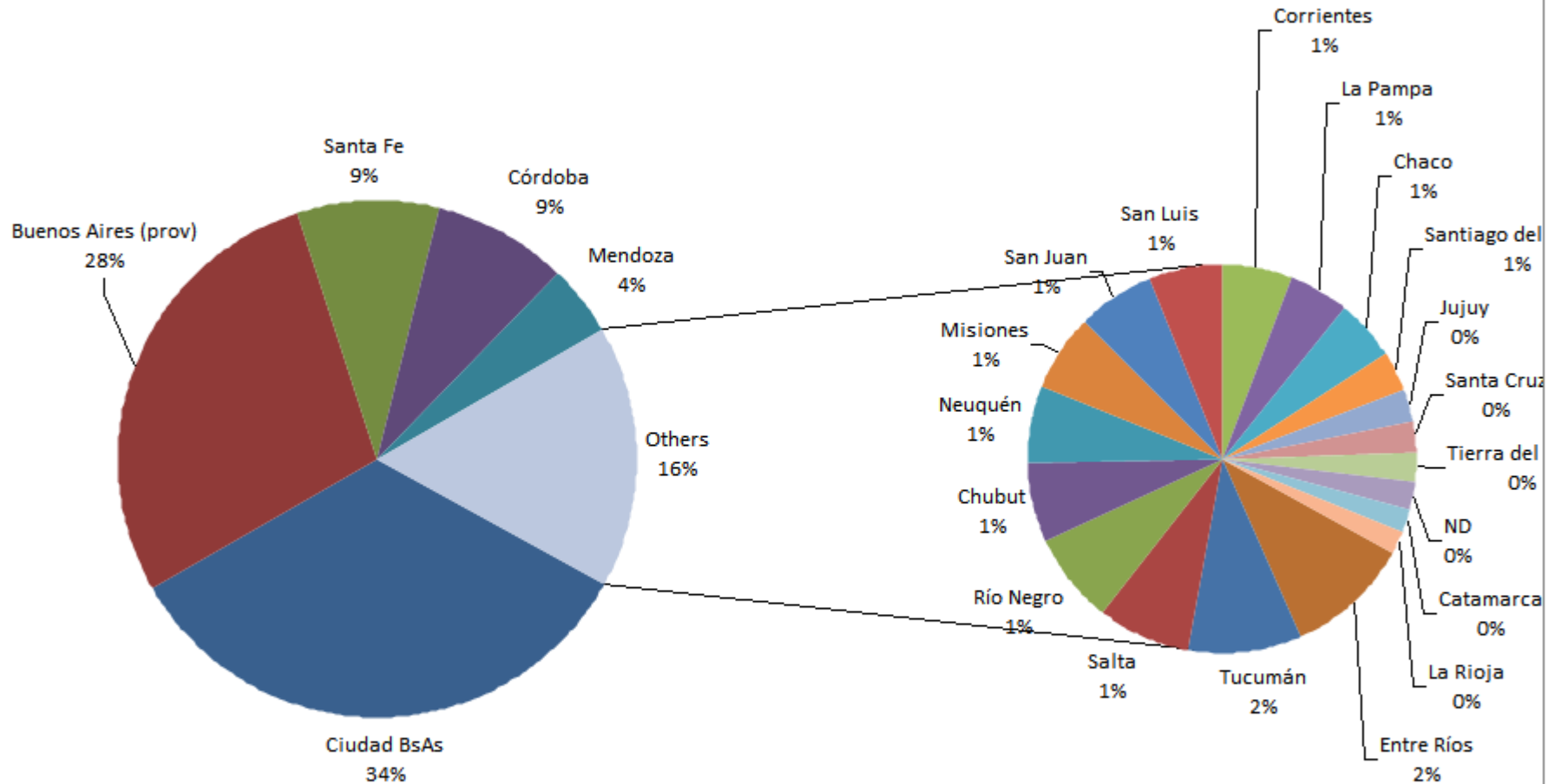


- We look at credit granted to private sector companies by FIs, so we leave out of the registry data set:
 - Credit granted from FIs to FIs
 - Public sector institutions or companies
 - Credit granted by non-financial institutions (not supervised or regulated by BCRA)
- Sample size still close to 4.5 M (4,455,316 observations and 457,671 relationships after dropping top 1% outliers.)



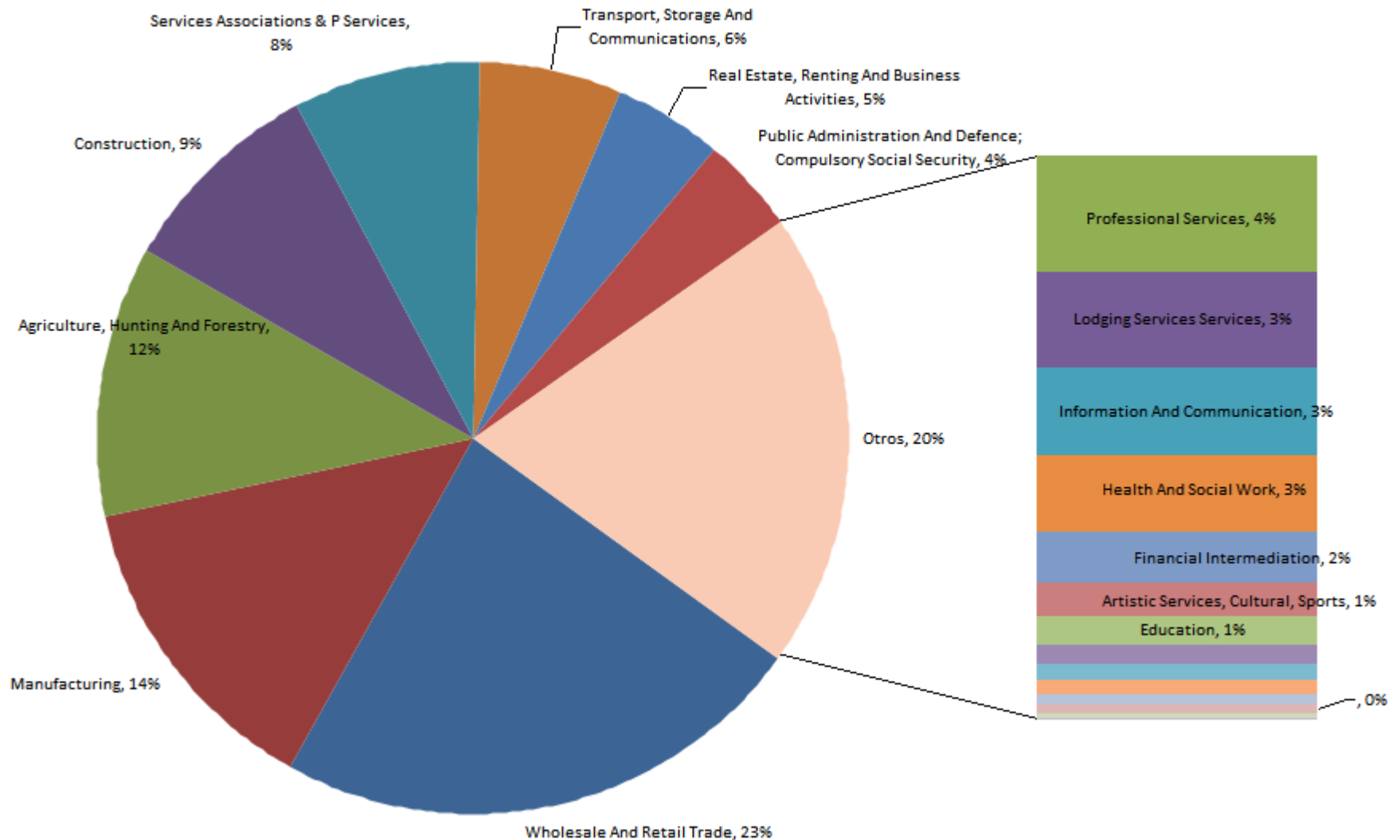
Firms' geographical distribution

Firms





Economic Activities

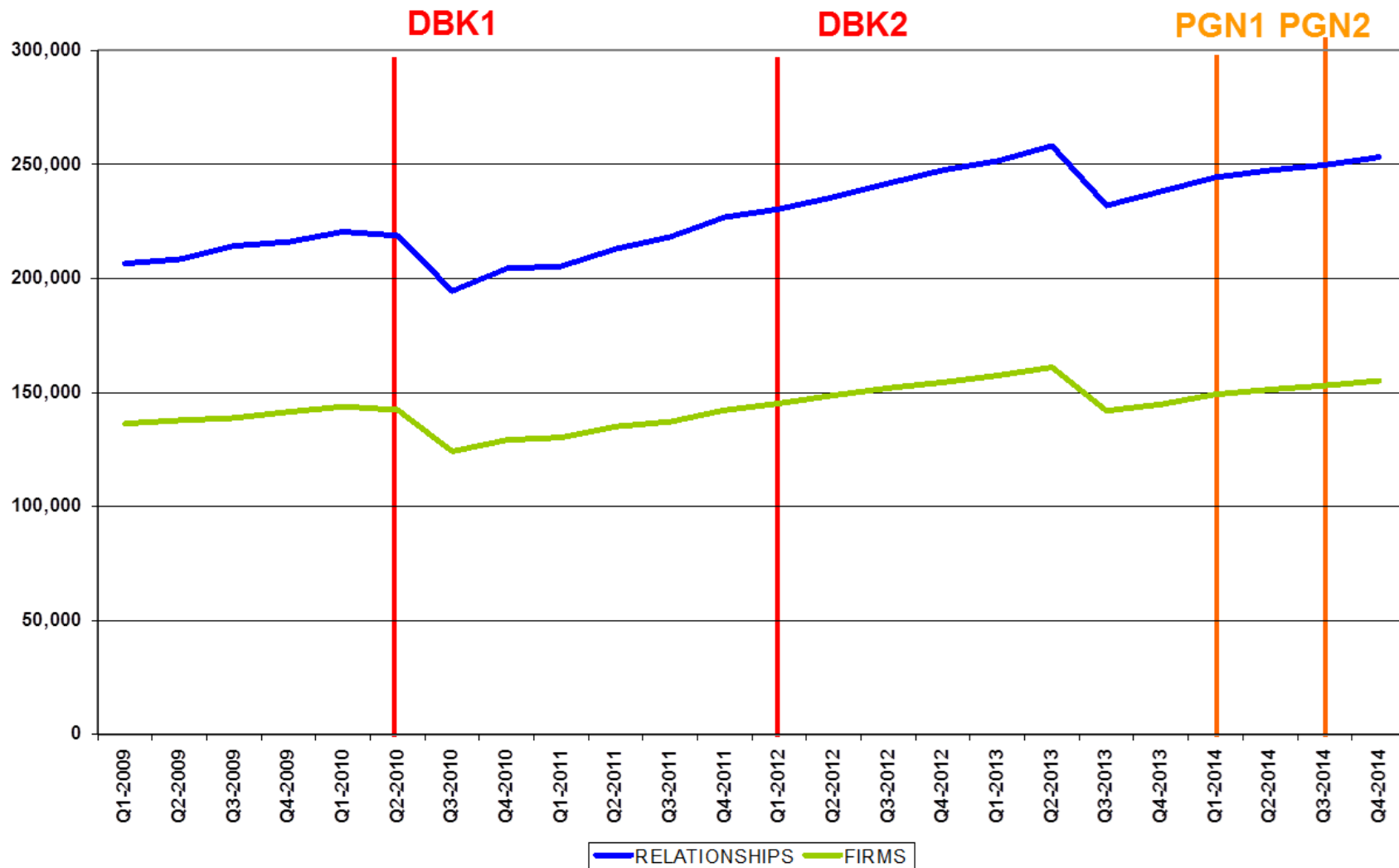




- We also estimated the models on a subsample of relationships that were “alive” for the whole period under analysis (2,583,803 observations and 182,960 relationships).
- This procedure, allows us to explore the intensive and the extensive margins of the effects of MPP on credit.

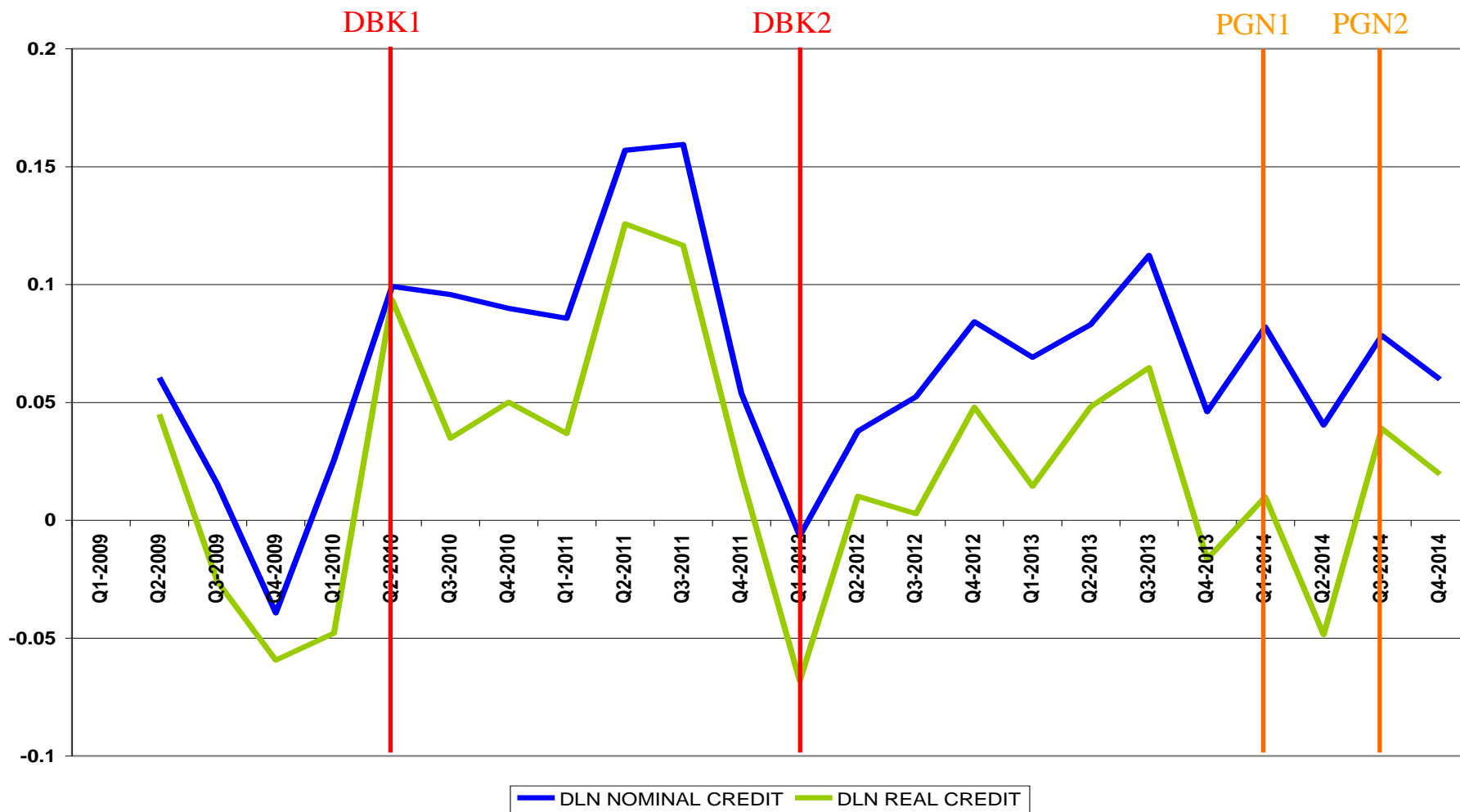


Firms, firm-FI relationships & MPP





Firms' debt growth & selected MPP





Capital requirements			
		Mean	Std. Dev.
<i>DBK1 (II-2010)</i>	Before	0,027	1,194
	After	-0,017	1,045
<i>DBK2 (I-2012)</i>	Before	0,045	1,113
	After	-0,050	1,040
Overall net open position			
		Mean	Std. Dev.
<i>PGN_1 (I-2014)</i>	Before	0,048	1,075
	After	-0,204	1,045
<i>PGN_2 (III-2014)</i>	Before	0,041	1,060
	After	-0,325	1,108



- We use a variant of equation (2) in the protocol

$$\Delta \text{Log Credit}_{bft} = \delta_f + \sum_{j=0}^4 \beta_j \Delta \text{Macro tool}_{t-j} + \text{controls}_{bft} + \text{quarter}_t + \varepsilon_{bft}$$

- **Dependent variable:** change of the logarithm of real debt held by company i granted by FI j . Real debt is nominal one deflated by the GDP deflator (year base 2004).
- **Independent variables**
 - Macroprudential tools: dummy variables for:
 - capital buffer (II-2010, I-2012) ;
 - foreign currency net global position (I-2014, III-2014).

We look at **impact** (dummy only in 1 quarter), **impact and one lag**, **impact and lag (only one dummy)**, **complete period of implementation**, and **impact and one lag (only one dummy) with lagged controls**.



■ Independent variables

● Macroeconomic controls:

- quarterly change in real GDP (not seasonally adjusted);
- change in money market rate (BADLAR, AR\$, private sector);
- change in nominal exchange rate (AR\$/USD);
- the balance of the foreign exchange market, defined as total operations of the financial system (including the Central Bank) with the non-financial private and public sectors, and the rest of the world. (We consider this variable to be a better indicator of external conditions for the financial system than the current account or capital account of the balance of payments, as it shows directly whether the financial system as a whole is a net buyer or seller in the foreign exchange market.)



■ Independent variables

- Financial Institutions variables comprise :
 - log of net total assets;
 - liquidity ratio (liquid assets as % of total deposits);
 - capital to assets ratio (equity to total assets);
 - deposits to liabilities ratio;
- Firm level controls:
 - types of credit that the firm has taken, and
 - Log of number of FIs that the firm is working with in each quarter.



Baseline model

All firms, total credit

	1	2	3	4	5
Dependent variable:	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DLN_MONTO_R					
DBK1_I	-0.01303*** -0.003034	0.05470*** -0.003726			
DBK2_I	0.03192*** -0.00304	-0.1367*** -0.003892			
PGN1_I	0.2797*** -0.00695	0.4486*** -0.01115			
PGN2_I	-0.04653*** -0.00257	-0.1930*** -0.00338			
DBK1_I_L1		-0.05075*** -0.002925			
DBK2_I_L1		-0.2088*** -0.004337			
PGN1_I_L1		-0.1110*** -0.003287			
PGN2_I_L1		-0.1873*** -0.002881			
DBK1_C1			-0.01139*** -0.001958		-0.03411*** (0.002485)
DBK2_C1			-0.07137*** -0.00279		-0.09682*** (0.005417)
PGN1_C1			-0.1606*** -0.003058		0.1307*** (0.008358)
PGN2_C1			-0.1155*** -0.002187		-0.1297*** (0.002783)
DBK1_E				-0.02249*** -0.00175	
DBK2_E				-0.1124*** -0.002163	
PGN1_E				-0.1683*** -0.002903	
PGN2_E				-0.1116*** -0.002014	

Besides **statistical** **significance**, estimated coefficients show **economic significance**.

The introduction of the capital buffer reduces firm's credit growth by 1% to 3% quarterly (on average over two quarters), and by 2% quarterly during the whole period of implementation; there is higher impact of the tightening of this measure, that ranges from -7% to -11% quarterly.

Limits to the global currency position also yield effects lower than -10% quarterly; but under two specifications their introduction shows a positive sign.



	1	2	3	4	5
Dependent variable:	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DLN_MONTO_R					
DLN_GDP_R	0.02756 -0.03927	-2.3830*** -0.06995	-0.3084*** -0.04281	-0.007041 -0.0342	-0.1426 (0.08914)
DBADLAR_PRI	0.01150*** -0.0003065	-0.006835*** -0.0004046	0.001329*** -0.0003508	-8.612e-04** -0.0003393	-0.007347*** (5.411e-04)
Δ exchange rate	-0.2505*** -0.005058	-0.3928*** -0.007927	0.02431*** -0.002768	0.07443*** -0.003009	-0.09843*** (0.005029)
Δ foreign_XR_balance	-5.111e-06*** -2.21E-07	3.060e-06*** -0.00000029	5.369e-06*** -2.71E-07	2.962e-06*** -2.29E-07	6.901e-06*** (3.014e-07)
DLN_GDP_R_L1					0.2813*** (0.05551)
DBADLAR_PRI_L1					0.001233*** (4.173e-04)
Δ exchange rate_L1					-0.2229*** (0.007105)
Δ foreign_XR_balance_L1					-5.956e-07* (3.548e-07)

GDP growth is not significant for the impact estimation and for the whole period the policies were in place; but its lagged value is positive and significant. The contemporary and lagged values are positive and significant in the equation with impact and lag dummies of the policy variables (not reported here).

Money market interest rates are associated to lower credit growth when both contemporaneous and lagged effects are allowed for, the impact is negative but the lag is positive, while the sum of both coefficients is still negative.



	1	2	3	4	5
Dependent variable:	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DLN_MONTO_R					
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DBADLAR_PRI	0.01150*** -0.0003065	-0.006835*** -0.0004046	0.001329*** -0.0003508	-8.612e-04** -0.0003393	-0.007347*** (5.411e-04)
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Δ exchange rate_L1					-0.2229*** (0.007105)
Δ foreign_XR_balance_L1					-5.956e-07* (3.548e-07)

In general, **exchange rate depreciation** (i.e. the local currency depreciating with respect to the US dollar) weighs negatively on credit growth, while a **higher balance of the foreign exchange market** is usually (but not in every specification) associated to higher credit growth.

This two effects are consistent with anecdotal evidence of the disruptive impact on financial stability of foreign exchange depreciations and foreign exchange market turbulence.



Baseline model some controls

As for financial institutions' controls, banks with more capital and liquidity, and with a higher share of deposits to total assets, generally show higher credit growth granted to firms.

Their size as measured by total assets, however, appears to be negatively linked to credit growth.

Firms control show that those companies working with a larger quantity of financial institutions also hold credit at higher rates; and that the type of credit they hold is related to its growth (Excl. Var. Promissory notes and overdraft).

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
Bank_capital_ratio_L1	-0.001017*** -0.0003837	0.002978*** -0.0003879	-0.003455*** -0.000372	0.002298*** -0.00038	-2.710e-04 (4.798e-04)
Bank_liquidity_L1	4.41E-07 -1.406E-06	3.435e-06*** -1.106E-06	4.36E-07 -1.091E-06	4.175e-06*** -0.000001123	2.385e-06*** (7.713e-07)
Ln(total_assets)_L1	-0.3015*** -0.005937	-0.06230*** -0.006822	-0.2866*** -0.005482	-0.04928*** -0.006995	-0.05468*** (0.01180)
Deposits_to_totliabilities_L1	4.359e-04** -0.0001808	0.001112*** -0.0001819	0.0000851 -0.0001805	0.001867*** -0.0001882	0.003320*** (2.574e-04)
Bank_capital_ratio_L2					0.004582*** (4.917e-04)
Bank_liquidity_L2					5.495e-08 (7.542e-07)
Ln(total_assets)_L2					-0.02784** (0.01167)
Deposits_to_totliabilities_L2					-0.001999*** (2.506e-04)

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
LNNBCRASUP	0.01057*** -0.002041	0.01158*** -0.002041	0.009993*** -0.002042	0.01352*** -0.002042	0.01561*** (0.002102)
grlin2 (real guaranty)	0.09255*** -0.002588	0.09028*** -0.002605	0.08917*** -0.002593	0.08942*** -0.002605	0.09177*** (0.002681)
grlin3 (personal)	-0.1020*** -0.01317	-0.09658*** -0.01312	-0.09115*** -0.01313	-0.1006*** -0.01314	-0.08663*** (0.01336)
grlin4 (credit card)	0.08747*** -0.00244	0.09442*** -0.002446	0.08911*** -0.002446	0.09502*** -0.002448	0.09143*** (0.002516)
grlin6 (others)	0.1893*** -0.003151	0.1908*** -0.003157	0.1920*** -0.003158	0.1902*** -0.003156	0.1902*** (0.003213)
grlin7 (export fin)	0.2356*** -0.007737	0.2291*** -0.007787	0.2155*** -0.007799	0.2288*** -0.007767	0.2336*** (0.007874)



Firms with debt in all periods, total credit

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DBK1_I	-0.01303*** (-0.003034)	0.05470*** (-0.003726)			
DBK2_I	0.03192*** (-0.00304)	-0.1367*** (-0.003892)			
PGN1_I	0.2797*** (-0.00695)	0.4486*** (-0.01115)			
PGN2_I	-0.04653*** (-0.00257)	-0.1930*** (-0.00338)			
DBK1_I_L1		-0.05075*** (-0.002925)			
DBK2_I_L1		-0.2088*** (-0.004337)			
PGN1_I_L1		-0.1110*** (-0.003287)			
PGN2_I_L1		-0.1873*** (-0.002881)			
DBK1_C1			-0.01139*** (-0.001958)		-0.03411*** (0.002485)
DBK2_C1			-0.07137*** (-0.00279)		-0.09682*** (0.005417)
PGN1_C1			-0.1606*** (-0.003058)		0.1307*** (0.008358)
PGN2_C1			-0.1155*** (-0.002187)		-0.1297*** (0.002783)
DBK1_E				-0.02249*** (-0.00175)	
DBK2_E				-0.1124*** (-0.002163)	
PGN1_E				-0.1683*** (-0.002903)	
PGN2_E				-0.1116*** (-0.002014)	

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DBK1_I	0.01298*** (0.003580)	0.06243*** (0.004350)			
DBK2_I	0.006153* (0.003480)	-0.1266*** (0.004476)			
PGN1_I	0.2689*** (0.008166)	0.3851*** (0.01285)			
PGN2_I	-0.03279*** (0.003109)	-0.1428*** (0.003956)			
DBK1_I_L1		-0.05129*** (0.003376)			
DBK2_I_L1		-0.1738*** (0.005064)			
PGN1_I_L1		-0.09659*** (0.003906)			
PGN2_I_L1		-0.1368*** (0.003412)			
DBK1_C1			-0.006445*** (0.002299)		-0.03113*** (0.002919)
DBK2_C1			-0.05770*** (0.003282)		-0.08845*** (0.006379)
PGN1_C1			-0.1406*** (0.003646)		0.1116*** (0.009695)
PGN2_C1			-0.07515*** (0.002607)		-0.08992*** (0.003279)
DBK1_E				-0.01255*** (0.002024)	
DBK2_E				-0.08826*** (0.002466)	
PGN1_E				-0.1478*** (0.003458)	
PGN2_E				-0.07112*** (0.002400)	

Estimated coefficients are generally smaller in this subsample, which we interpret as a difference between intensive and extensive margins: the latter would be somewhat smaller than the former, implying a **higher impact on credit growth through the granting of credit to less companies rather than on less credit to the same firms.**



All firms non performing loans

The ultimate aim of macroprudential policy should be to strengthen the resilience of the financial system, hence we want to incorporate an indicator of ex post solvency risk: the model is estimated for growth of non-performing loans, as classified by financial institutions.

We can say that both type of measures actually contributed to decreasing ex post riskier loans in banks' portfolios.

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DBK1_I	-0.01121*** (0.002557)	0.04885*** (0.002860)			
DBK2_I	-0.03296*** (0.002725)	-0.1416*** (0.003309)			
PGN1_I	-0.05997*** (0.007662)	0.1334*** (0.009608)			
PGN2_I	0.02694*** (0.002391)	-0.06745*** (0.002903)			
DBK1_I_L1		-0.08022*** (0.002370)			
DBK2_I_L1		-0.1666*** (0.004409)			
PGN1_I_L1		-0.03621*** (0.003369)			
PGN2_I_L1		-0.08824*** (0.002609)			
DBK1_C1			-0.03061*** (0.001571)		-0.04962*** (0.002003)
DBK2_C1			-0.1029*** (0.002945)		-0.02541*** (0.004955)
PGN1_C1			-0.06857*** (0.003307)		-0.09147*** (0.007289)
PGN2_C1			-0.04369*** (0.002087)		-0.03862*** (0.002509)
DBK1_E				-0.04872*** (0.001431)	
DBK2_E				-0.07933*** (0.001795)	
PGN1_E				-0.03757*** (0.003270)	
PGN2_E				-0.008149*** (0.001920)	



Firms with debt in all periods non performing loans

Once again we find that the introduction of the capital buffer entails a higher impact for NPLs than for total credit, in all models employed; and that the re-introduction of the global net foreign currency position goes from a positive to negative effect on growth when we look at NPL instead of total credit, and lags for controls.

	1	2	3	4	5
Dependent variable: DLN_MONTO_R	Impact effect	Impact effect and lags	Impact effect and lags as an only dummy	Effect during complete period of implementation	Impact effect and lags as an only dummy (with lag controls)
DBK1_I	0.01075*** (0.002631)	0.03451*** (0.002836)			
DBK2_I	-0.01920*** (0.002568)	-0.09934*** (0.003056)			
PGN1_I	0.06528*** (0.006762)	0.1113*** (0.009042)			
PGN2_I	0.02246*** (0.002315)	-0.03952*** (0.002675)			
DBK1_I_L1		-0.06341*** (0.002445)			
DBK2_I_L1		-0.1165*** (0.004618)			
PGN1_I_L1		-0.07222*** (0.002978)			
PGN2_I_L1		-0.04676*** (0.002490)			
DBK1_C1			-0.02483*** (0.001655)		-0.03549*** (0.002021)
DBK2_C1			-0.06207*** (0.002926)		-0.01749*** (0.004772)
PGN1_C1			-0.09892*** (0.002863)		-0.06677*** (0.007085)
PGN2_C1			-0.01190*** (0.001969)		-0.01523*** (0.002340)
DBK1_E				-0.03380*** (0.001477)	
DBK2_E				-0.05214*** (0.001695)	
PGN1_E				-0.07889*** (0.002767)	
PGN2_E				0.009585*** (0.001873)	



Baseline model sensitivity analysis

VARIABLES	FULL			WITHOUT PGN1			ONLY PGN1			FULL 2009-Q2		
	2009-Q2	2010-Q2	2011-Q2	2009-Q2	2010-Q2	2011-Q2	2009-Q2	2010-Q2	2011-Q2	75% Sample	50% Sample	25% Sample
	DLNMONTO_R (1)	DLNMONTO_R (2)	DLNMONTO_R (3)	DLNMONTO_R (4)	DLNMONTO_R (5)	DLNMONTO_R (6)	DLNMONTO_R (7)	DLNMONTO_R (8)	DLNMONTO_R (9)	DLNMONTO_R (10)	DLNMONTO_R (11)	DLNMONTO_R (12)
DBK1_I	-0.01303*** (0.003034)	0.08966*** (0.003406)	- (0.003986)	-0.01215*** (0.003034)	0.08725*** (0.003408)	- (0.003948)				-0.01132*** (0.003537)	-0.007135 (0.004342)	0.006409 (0.006533)
DBK2_I	0.03192*** (0.003040)	0.05830*** (0.003247)	0.1572*** (0.003986)	0.02507*** (0.003038)	0.05222*** (0.003242)	0.1310*** (0.003948)				0.03092*** (0.003548)	0.02076*** (0.004342)	0.008865 (0.006504)
PGN1_I	0.2797*** (0.006950)	0.3970*** (0.007576)	0.4426*** (0.008200)				0.2572*** (0.006883)	0.3627*** (0.007465)	0.3771*** (0.007968)	0.2900*** (0.008128)	0.3039*** (0.01001)	0.3146*** (0.01528)
PGN2_I	-0.04653*** (0.002570)	-0.04397*** (0.002695)	-0.003144 (0.002826)	-0.03643*** (0.002549)	-0.02552*** (0.002666)	0.01555*** (0.002800)				-0.04861*** (0.003005)	-0.05375*** (0.003694)	-0.05406*** (0.005672)
DLNGDP_R	0.02756 (0.03927)	-0.05799 (0.04733)	0.03639 (0.05152)	0.1496*** (0.03919)	-0.2201*** (0.04727)	-0.1544*** (0.05149)	-0.1326*** (0.03286)	0.5626*** (0.03946)	0.3038*** (0.05136)	-0.01246 (0.04570)	0.1567*** (0.05576)	0.3905*** (0.08358)
DBADLAR_PRI	0.01150*** (3.065e-04)	0.01764*** (3.763e-04)	0.02721*** (4.253e-04)	0.01198*** (3.060e-04)	0.01938*** (3.752e-04)	0.02818*** (4.260e-04)	0.01282*** (2.395e-04)	0.01495*** (2.657e-04)	0.01912*** (2.993e-04)	0.01126*** (3.579e-04)	0.01015*** (4.378e-04)	0.007585*** (6.570e-04)
DTC_REF	-0.2505*** (0.005058)	-0.3746*** (0.005610)	-0.4156*** (0.006097)	-0.06751*** (0.002191)	-0.1078*** (0.002348)	-0.1166*** (0.002556)	-0.2503*** (0.005050)	-0.3472*** (0.005547)	-0.3839*** (0.006041)	-0.2573*** (0.005944)	-0.2699*** (0.007309)	-0.2793*** (0.01108)
DNETO_MULC	-5.111e-06*** (2.214e-07)	-1.091e-05*** (2.734e-07)	-2.054e-05*** (3.179e-07)	-3.383e-06*** (2.174e-07)	-9.183e-06*** (2.705e-07)	-1.750e-05*** (3.119e-07)	-3.632e-06*** (1.977e-07)	-7.173e-06*** (2.350e-07)	-1.287e-05*** (2.560e-07)	-5.402e-06*** (2.575e-07)	-4.440e-06*** (3.152e-07)	-4.133e-06*** (4.753e-07)
KRAT_L1	-0.001017*** (3.837e-04)	0.002222*** (4.127e-04)	2.091e-04 (5.280e-04)	-0.005112*** (3.693e-04)	-0.003950*** (3.949e-04)	-0.007606*** (5.095e-04)	-0.002008*** (3.794e-04)	5.570e-04 (4.079e-04)	-0.003959*** (5.192e-04)	-7.422e-04* (4.511e-04)	-0.001501*** (5.548e-04)	-0.001498* (8.243e-04)
LIQUI_L1	4.409e-07 (1.406e-06)	3.452e-06** (1.450e-06)	6.074e-06*** (1.599e-06)	-6.258e-07 (1.405e-06)	7.942e-07 (1.439e-06)	2.741e-06* (1.435e-06)	4.827e-07 (1.435e-06)	2.783e-06* (1.566e-06)	4.712e-06*** (1.784e-06)	5.129e-07 (1.405e-06)	8.046e-07 (1.474e-06)	9.421e-07 (1.696e-06)
LNTOTASSET_R_L1	-0.3015*** (0.005937)	-0.1755*** (0.007888)	-0.05963*** (0.01093)	-0.4087*** (0.005199)	-0.3979*** (0.006519)	-0.3735*** (0.009112)	-0.3116*** (0.005827)	-0.2483*** (0.007614)	-0.2106*** (0.01034)	-0.2977*** (0.006973)	-0.2807*** (0.008539)	-0.2391*** (0.01288)
DEPTOLIA_L1	4.359e-04** (1.808e-04)	0.003810*** (2.199e-04)	0.004785*** (2.601e-04)	2.907e-04 (1.814e-04)	0.002247*** (2.185e-04)	0.002480*** (2.568e-04)	2.938e-04 (1.791e-04)	0.003299*** (2.193e-04)	0.004153*** (2.595e-04)	5.279e-04** (2.126e-04)	0.001219*** (2.606e-04)	0.001580*** (3.905e-04)
LNNBCRASUP	0.01057*** (0.002041)	0.01459*** (0.002301)	0.02133*** (0.002701)	0.009741*** (0.002042)	0.01392*** (0.002304)	0.02054*** (0.002704)	0.01022*** (0.002041)	0.01448*** (0.002301)	0.01908*** (0.002701)	0.007335*** (0.002392)	0.01494*** (0.002914)	0.01446*** (0.004365)
grlin2	0.09255*** (0.002588)	0.1024*** (0.002966)	0.1295*** (0.003606)	0.09057*** (0.002583)	0.1002*** (0.002957)	0.1269*** (0.003593)	0.09191*** (0.002586)	0.1015*** (0.002959)	0.1282*** (0.003593)	0.09369*** (0.003020)	0.09112*** (0.003668)	0.08530*** (0.005368)
grlin3	-0.1020*** (0.01317)	-0.09931*** (0.01770)	-0.01503 (0.02185)	-0.1009*** (0.01317)	-0.09851*** (0.01773)	-0.01798 (0.02192)	-0.1052*** (0.01317)	-0.08780*** (0.01767)	-0.01810 (0.02185)	-0.09590*** (0.01533)	-0.07492*** (0.01875)	-0.09104*** (0.02819)
grlin4	0.08747*** (0.002440)	0.08507*** (0.002754)	0.09219*** (0.003184)	0.08519*** (0.002441)	0.08098*** (0.002754)	0.08830*** (0.003184)	0.08667*** (0.002440)	0.08273*** (0.002752)	0.08880*** (0.003181)	0.08816*** (0.002842)	0.08619*** (0.003441)	0.08743*** (0.005131)
grlin6	0.1893*** (0.003151)	0.1877*** (0.003416)	0.1771*** (0.003883)	0.1908*** (0.003153)	0.1891*** (0.003419)	0.1788*** (0.003885)	0.1898*** (0.003150)	0.1878*** (0.003414)	0.1789*** (0.003881)	0.1882*** (0.003630)	0.1837*** (0.004402)	0.1777*** (0.006452)
grlin7	0.2356*** (0.007737)	0.2367*** (0.008005)	0.2419*** (0.008861)	0.2244*** (0.007752)	0.2222*** (0.008020)	0.2282*** (0.008874)	0.2324*** (0.007736)	0.2335*** (0.007998)	0.2361*** (0.008864)	0.2287*** (0.008966)	0.2266*** (0.01078)	0.2002*** (0.01510)
Q2	0.01838*** (0.006190)	0.01379* (0.007756)	0.05715*** (0.008860)	-0.02581*** (0.006092)	0.01409* (0.007761)	0.04805*** (0.008861)	0.02947*** (0.005486)	-0.09915*** (0.006669)	-0.05609*** (0.008539)	0.02635*** (0.007208)	-0.01158 (0.008792)	-0.05030*** (0.01325)
Q3	-0.01708*** (0.003060)	-0.04825*** (0.003358)	-0.09450*** (0.004176)	-0.03886*** (0.003007)	-0.05690*** (0.003356)	-0.1056*** (0.004170)	-0.02120*** (0.002679)	-0.09826*** (0.003025)	-0.1300*** (0.004007)	-0.01776*** (0.003555)	-0.02002*** (0.004339)	-0.03591*** (0.006495)
Q4	0.02053*** (0.004869)	-1.754e-04 (0.005574)	-0.01345** (0.006369)	-0.01292*** (0.004800)	-0.007501 (0.005577)	-0.02961*** (0.006363)	0.02809*** (0.004212)	-0.08510*** (0.004802)	-0.08262*** (0.006242)	0.02923*** (0.005673)	0.003678 (0.006635)	-0.01353 (0.01043)
Constant	3.1069*** (0.06173)	1.4880*** (0.08591)	0.1823 (0.1206)	4.2982*** (0.05281)	4.0185*** (0.06960)	3.7723*** (0.09880)	3.2332*** (0.06013)	2.3857*** (0.08231)	1.9642*** (0.1131)	3.0537*** (0.07250)	2.8368*** (0.08874)	2.3843*** (0.1341)
Observations	4,455,316	3,746,688	3,060,430	4,455,316	3,746,688	3,060,430	4,455,316	3,746,688	3,060,430	3,377,663	2,331,232	1,173,102
R-squared	0.007	0.009	0.010	0.006	0.008	0.009	0.006	0.009	0.010	0.007	0.007	0.008
Number of RELA_id	457,671	419,456	381,477	457,671	419,456	381,477	457,671	419,456	381,477	451,473	429,603	391,515



Baseline model sensitivity analysis (AF)

	Impact effect (1a)		Impact effect and lags (2a)		Effect during complete period of implementation (1b)		Impact effect and lags as an only dummy (with lag controls) (2b)		Impact effect and lags (with no lag controls)		Impact effect and lags as an only dummy (with no lag controls)	
Dependent variable: DLN_MONTO_R	_F	_N	_F	_N	_F	_N	_F	_N	_F	_N	_F	_N
DBK1_I	-0.01303***	-0.01750***	0.07034***	-0.08025***					0.05470***	-0.02083***		
	-0.003034	(0.003014)	(0.005868)	(0.003819)					(0.003726)	(0.003140)		
DBK2_I	0.03192***	0.03540***	-0.03179***	-0.07423***					-0.1367***	0.04014***		
	-0.00304	(0.002936)	(0.009822)	(0.005648)					(0.003892)	(0.003105)		
PGN1_I	0.2797***		0.9084***						0.4486***			
	-0.00695		(0.03356)						(0.01115)			
PGN2_I	-0.04653***		-0.3309***						-0.1930***			
	-0.00257		(0.01047)						(0.003380)			
DBK1_I_L1			-0.03905***	-0.004053					-0.05075***	0.007856***		
			(0.004105)	(0.003792)					(0.002925)	(0.002722)		
DBK2_I_L1			0.1062***	0.1322***					-0.2088***	0.01100***		
			(0.01174)	(0.005436)					(0.004337)	(0.003100)		
PGN1_I_L1			-1.0526***						-0.1110***			
			(0.05611)						(0.003287)			
PGN2_I_L1			-0.07934***						-0.1873***			
			(0.006277)						(0.002881)			
DBK1_C1							-0.03411***	-0.05004***			-0.01139***	-0.005213***
							(0.002485)	(0.002389)			(0.001958)	(0.001919)
DBK2_C1							-0.09682***	0.02844***			-0.07137***	0.01870***
							(0.005417)	(0.004171)			(0.002790)	(0.002370)
PGN1_C1							0.1307***				-0.1606***	
							(0.008358)				(0.003058)	
PGN2_C1							-0.1297***				-0.1155***	
							(0.002783)				(0.002187)	
DBK1_E					-0.02249***	-0.03102***						
					-0.00175	(0.001724)						
DBK2_E					-0.1124***	-0.08349***						
					-0.002163	(0.002111)						
PGN1_E					-0.1683***							
					-0.002903							
PGN2_E					-0.1116***							
					-0.002014							

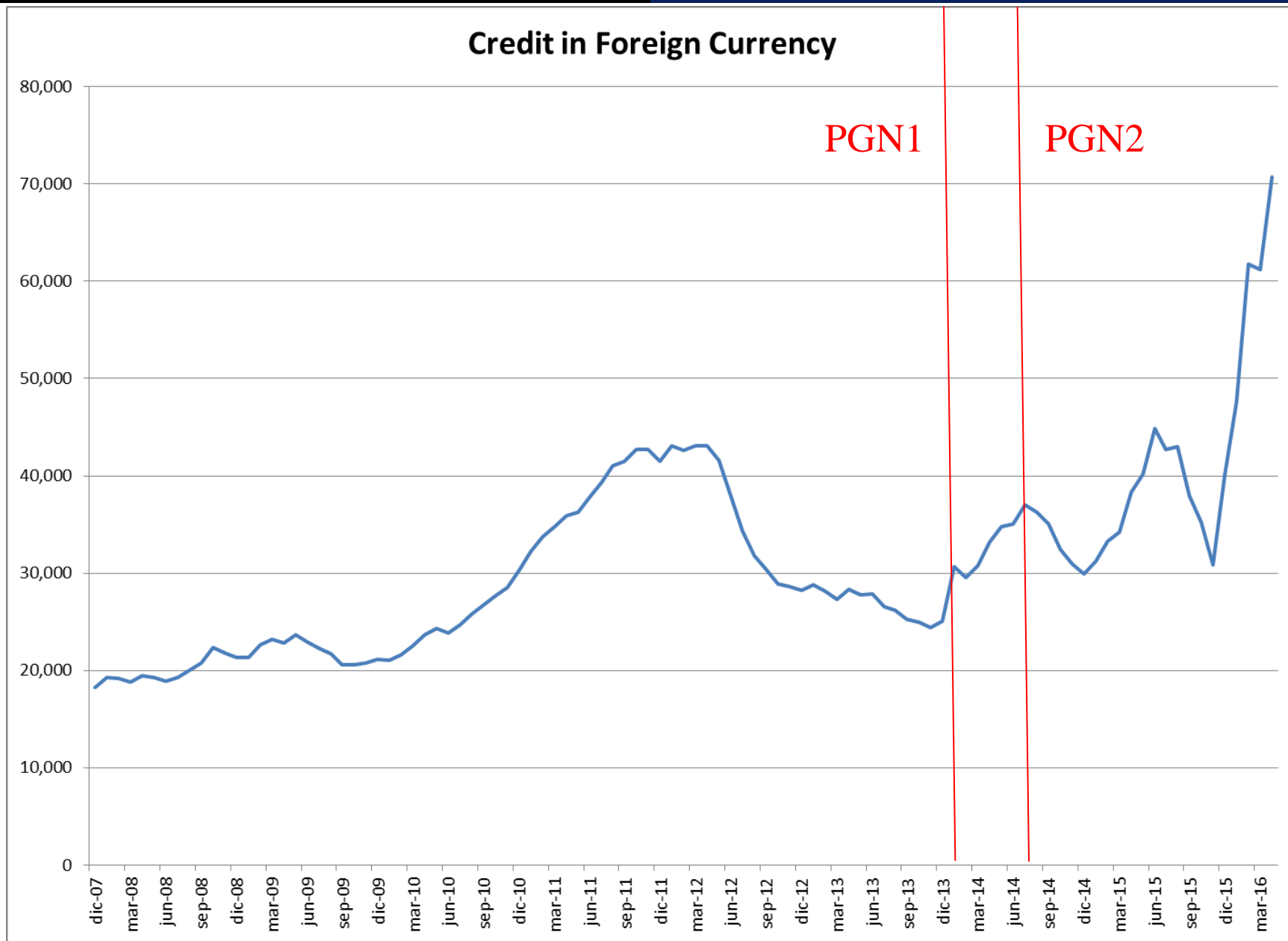


Debt in all periods sensitivity analysis (AP)

	Impact effect (1a)		Impact effect and lags (2a)		Effect during complete period of implementation (1b)		Impact effect and lags as an only dummy (with lag controls) (2b)		Impact effect and lags (with no lag controls)		Impact effect and lags as an only dummy (with no lag controls)	
Dependent variable: DLN_MONTO_R	_F	_N	_F	_N	_F	_N	_F	_N	_F	_N	_F	_N
DBK1_I	0.01298*** (0.003580)	0.009860*** (0.003562)	0.07045*** (0.006817)	-0.04219*** (0.004482)					0.06243*** (0.004350)	0.009650*** (0.003713)		
DBK2_I	0.006153* (0.003480)	0.006957** (0.003363)	-0.07823*** (0.01142)	-0.08960*** (0.006726)					-0.1266*** (0.004476)	0.007133** (0.003586)		
PGN1_I	0.2689*** (0.008166)		0.6908*** (0.03887)						0.3851*** (0.01285)			
PGN2_I	-0.03279*** (0.003109)		-0.2345*** (0.01220)						-0.1428*** (0.003956)			
DBK1_I_L1			-0.05147*** (0.004804)	-0.02944*** (0.004453)					-0.05129*** (0.003376)	-0.003547 (0.003140)		
DBK2_I_L1			0.04620*** (0.01365)	0.07484*** (0.006380)					-0.1738*** (0.005064)	0.001864 (0.003696)		
PGN1_I_L1			-0.7155*** (0.06527)						-0.09659*** (0.003906)			
PGN2_I_L1			-0.05240*** (0.007306)						-0.1368*** (0.003412)			
DBK1_C1							-0.03113*** (0.002919)	-0.04327*** (0.002804)			-0.006445*** (0.002299)	0.001989 (0.002256)
DBK2_C1							-0.08845*** (0.006379)	0.005697 (0.004936)			-0.05770*** (0.003282)	0.006924** (0.002792)
PGN1_C1							0.1116*** (0.009695)				-0.1406*** (0.003646)	
PGN2_C1							-0.08992*** (0.003279)				-0.07515*** (0.002607)	
DBK1_E					-0.01255*** (0.002024)	-0.01882*** (0.001999)						
DBK2_E					-0.08826*** (0.002466)	-0.06907*** (0.002411)						
PGN1_E					-0.1478*** (0.003458)							
PGN2_E					-0.07112*** (0.002400)							



Debt in all periods sensitivity analysis





Allowing for interaction terms between policy and control variables

All firms, total credit and complete period of implementation

		1	2	3
Dependent variable: DLNMONTA_R		Bank- characteristics	Money market	GDP
DBK1_E	-0.02249*** -0.00175	-0.07864*** (0.01965)	-0.024518*** 0.0020614	-0.0253115*** 0.0025401
DBK2_E	-0.1124*** -0.002163	-0.2667*** (0.02118)	-0.0889689*** 0.0024945	-0.0881894*** 0.0027198
PGN1_E	-0.1683*** -0.002903	-0.2521*** (0.01587)	0.25105*** 0.0188127	0.0734587*** 0.0087497
PGN2_E	-0.1116*** -0.002014	-0.3123*** (0.01757)	-0.137031*** 0.0028728	-0.1339053*** 0.0022938



For DBK1 Banks with higher capital and higher total assets felt a marginally higher impact of the measure; while the opposite applies to banks with a higher share of deposits to total liabilities; there is no significant interaction with liquidity.

The tightening of the buffer offers comparable readings in terms of size, except that banks with more assets can actually offset part of the measures impact.

	1	2	3
Dependent variable: DLNMONTO_R	Bank- characteristics	Money market	GDP
Bank capital ratio y DBK1_E	-0.002085*** (3.907e-04)		
Bank liquidity y DBK1_E	1.100e-04 (7.036e-05)		
Ln(total_assets) y DBK1_E	-0.004061*** (0.001442)		
Deposits to total liabilities y DBK1_E	0.001426*** (1.391e-04)		
Bank capital ratio y DBK2_E	-0.003396*** (4.267e-04)		
Bank liquidity y DBK2_E	9.975e-05 (6.915e-05)		
Ln(total_assets) y DBK2_E	0.008700*** (0.001533)		
Deposits to total liabilities y DBK2_E	0.001142*** (1.507e-04)		
Bank capital ratio y PGN1_E	-5.577e-04 (3.603e-04)		
Bank liquidity y PGN1_E	-4.718e-07 (9.470e-07)		
Ln(total_assets) y PGN1_E	-0.006509*** (0.001410)		
Deposits to total liabilities y PGN1_E	0.001980*** (1.009e-04)		
Bank capital ratio y PGN2_E	-0.002041*** (4.042e-04)		
Bank liquidity y PGN2_E	-1.747e-06 (1.081e-06)		
Ln(total_assets) y PGN2_E	-0.006868*** (0.001508)		
Deposits to total liabilities y PGN2_E	0.003571*** (1.244e-04)		



For the re-introduction of the global foreign currency position limit, there is no association of its impact with capital or liquidity, but bigger institutions in terms of assets evidence a higher impact of the measure, while those with a higher share of deposits in their liability structure show a lower effect.

The tightening of this limit involves a bigger effect on credit growth for bigger banks in terms of capital and assets, but a lower one for those with a higher deposit-to-liabilities ratio; there is, once again, no discernible association with liquidity.

	1	2	3
Dependent variable: DLNMONTO_R	Bank- characteristics	Money market	GDP
Bank capital ratio y DBK1_E	-0.002085*** (3.907e-04)		
Bank liquidity y DBK1_E	1.100e-04 (7.036e-05)		
Ln(total_assets) y DBK1_E	-0.004061*** (0.001442)		
Deposits to total liabilities y DBK1_E	0.001426*** (1.391e-04)		
Bank capital ratio y DBK2_E	-0.003396*** (4.267e-04)		
Bank liquidity y DBK2_E	9.975e-05 (6.915e-05)		
Ln(total_assets) y DBK2_E	0.008700*** (0.001533)		
Deposits to total liabilities y DBK2_E	0.001142*** (1.507e-04)		
Bank capital ratio y PGN1_E	-5.577e-04 (3.603e-04)		
Bank liquidity y PGN1_E	-4.718e-07 (9.470e-07)		
Ln(total_assets) y PGN1_E	-0.006509*** (0.001410)		
Deposits to total liabilities y PGN1_E	0.001980*** (1.009e-04)		
Bank capital ratio y PGN2_E	-0.002041*** (4.042e-04)		
Bank liquidity y PGN2_E	-1.747e-06 (1.081e-06)		
Ln(total_assets) y PGN2_E	-0.006868*** (0.001508)		
Deposits to total liabilities y PGN2_E	0.003571*** (1.244e-04)		



In general, at least one measure of bank size interacts negatively with the measure, denoting a more important impact of macroprudential policy on bigger banks, while there is no association with institutions' liquidity.

	1	2	3
Dependent variable: DLNMONTO_R	Bank- characteristics	Money market	GDP
Bank capital ratio y DBK1_E	-0.002085*** (3.907e-04)		
Bank liquidity y DBK1_E	1.100e-04 (7.036e-05)		
Ln(total_assets) y DBK1_E	-0.004061*** (0.001442)		
Deposits to total liabilities y DBK1_E	0.001426*** (1.391e-04)		
Bank capital ratio y DBK2_E	-0.003396*** (4.267e-04)		
Bank liquidity y DBK2_E	9.975e-05 (6.915e-05)		
Ln(total_assets) y DBK2_E	0.008700*** (0.001533)		
Deposits to total liabilities y DBK2_E	0.001142*** (1.507e-04)		
Bank capital ratio y PGN1_E	-5.577e-04 (3.603e-04)		
Bank liquidity y PGN1_E	-4.718e-07 (9.470e-07)		
Ln(total_assets) y PGN1_E	-0.006509*** (0.001410)		
Deposits to total liabilities y PGN1_E	0.001980*** (1.009e-04)		
Bank capital ratio y PGN2_E	-0.002041*** (4.042e-04)		
Bank liquidity y PGN2_E	-1.747e-06 (1.081e-06)		
Ln(total_assets) y PGN2_E	-0.006868*** (0.001508)		
Deposits to total liabilities y PGN2_E	0.003571*** (1.244e-04)		



As expected, estimated signs of the interaction between all measures analyzed and money market interest rates are negative; but only the interaction with PGN1 is statistically significant.

Interaction of GDP growth with the capital buffer is not significant (neither for introduction nor for tightening), whereas it is positive with the limit on global foreign currency position and statistically significant.

	1	2	3
Dependent variable: DLNMONTO_R	Bank- characteristics	Money market	GDP
BADLAR_RyDBK1_E		-0.0006724 0.0020684	
BADLAR_RyDBK2_E		-0.0007624 0.000402	
BADLAR_RyPGN1_E		-0.072645*** 0.0034036	
BADLAR_RyPGN2_E		0.0000913 0.0009457	
DLN_GDP_RyDBK1_E			-0.0036098 0.0284665
DLN_GDP_RyDBK2_E			-0.0204814 0.0346488
DLN_GDP_RyPGN1_E			2.122999*** 0.0729656
DLN_GDP_RyPGN2_E			-0.0150068 0.0313218



1. As all four instances of the measures' implementation were directly unrelated to credit growth, the exercise can be taken as quasi natural experiment to gauge the influence of macroprudential policy on what is conventionally considered its intermediate aim -curbing credit expansion.
2. All measures have a significant effect on credit growth at the firm-bank level.
3. There are differences between the initial impact and effects over time.
4. The capital buffer is generally associated to lower credit growth, both when introduced and when tightened.
5. Limits on global foreign currency position are linked to lower credit growth when tightened.



6. Macroprudential measures operate both on the extensive and the intensive margins: when the sample is adjusted to consider only firms that were always present in the credit market, all measures tend to reduce credit growth, and there is preliminary evidence to suggest that measures operate more through the granting of credit to less companies than to less credit to the same firms.
7. Macroprudential policies also have an effect on ex post credit quality: growth of non-performing loans is reduced after the implementation of such measures; in particular, the capital buffer reduces NPL expansion more than total credit.



8. **Interactions** between macroprudential measures, macroeconomic conditions and financial institutions variables **matter**: in general, banks with higher capital and more assets evidence a higher impact of the introduction of the capital buffer, while this measure also acts more acutely during economic activity expansions.
9. We **take our results as a first approximation toward a comprehensive assessment** of macroprudential measures impact.
10. The results presented here suggest that at granular level macroprudential **measures actually operate in the conventionally expected direction of taming credit booms, but more work is required to fully understand their effects.**



Ultimately, this type of policies should be aimed at increasing financial system resilience against shocks, and also at limiting negative spillovers from the system to the economy at large.

This requires an evaluation on several fronts, and looking at credit growth is only one of them, which may be relevant insofar as credit booms typically precede crisis.

But in financially underdeveloped economies, there may be a tradeoff between the financial development objective and macroprudential measures.

Therefore, we leave for future work the incorporation of financial institutions and firms' risk measures to the analysis.



BANCO CENTRAL
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Thanks for the attention

Gracias por su atención