

Can the Provision of Long-Term Liquidity Help to Avoid a Credit Crunch? Evidence from the Eurosystem's LTROs

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- Can central banks revive credit during a recession by pumping large amounts of liquidity into the banking system?
- Conventional wisdom: No!
 - Quantitative Easing is like “pushing on a rope”, as economy slides into a liquidity trap ([Keynes, 1936](#), [Samuelson, 1948](#)).
- The crisis and subsequent NSM policies revived debate about effectiveness of QE at the ZLB,
- Recent theoretical contributions have vindicated renewed interest in “bank lending channel” of MP at the ZLB:
 - See e.g., [Gertler and Kiyotaki \(2010\)](#), [Gertler and Karadi \(2011\)](#), [Benmelech and Bergman \(2012\)](#).
 - idea: injection of public liquidity alleviates financial frictions that impede credit supply.
- However, role of BLC in transmission of QE remains untested.

- We exploit the ECB's 3-year LTROs of 2011-2012 to evaluate:
 - capacity of the central bank to 'push on a rope' in the context of a financial crisis;
 - whether lengthening the maturity of the CB liquidity matters.
- Cross-sectional regression using a rich micro bank-firm dataset for France (including many multibank firms)
 - Control for firm's credit demand/specific risk using firm FEs for multibank firms;
 - Control for banks' characteristics using individual bank balance sheet information.
- French case is relevant: second largest euro area country + bank-based economy.
- First paper to evaluate a QE policy using bank-firm level data.

- LTROs had a **positive** impact on credit supply in France.
 - Controlling for credit demand and banks' risk, banks which used LTROs distributed more credit to customer firms than others.
 - On average: **1 billion** of LTRO take-up \Rightarrow increase by **95 millions** in loan supply.
- Moreover the positive impact of LTROs on firms' credit:
 - is almost exclusively associated with the **first round**, where bidders were more stressed (and stigma fears higher);
 - comes mostly from a substitution of short-term with **long-term** CB liquidity;
 - benefited **large borrowers** more (i.e. w/ ex ante borrowings size above 90th percentile);
 - **no** evidence that **ever-greening** of bad loans increased.

- Empirical literature on the bank lending channel :
 - impact of monetary policy shocks ([Kashyap and Stein, 1995, 2000](#); and [Jiménez et al., 2012](#)), other negative liquidity shocks ([Khwaja and Mian, 2008](#); [Schnabl, 2012](#)), including financial crisis of 2007-2009 ([Cornett et al., 2011](#); [Chodorow-Reich, 2014](#); [Iyer et al., 2014](#); [Puri et al., 2011](#)), or positive liquidity shocks ([Paravisini, 2008](#)).
- Assessment of non-conventional monetary policies, notably QE:
 - impact of (US) QE on asset prices (e.g., [d'Amico et al., 2012](#); [Christensen and Rudebusch, 2012](#); [Gagnon et al., 2011](#); [Krishnamurthy and Vissing-Jorgensen, 2011](#)), DSGE models featuring financial intermediation with frictions ([Chen et al., 2012](#), [Gertler and Karadi, 2011, 2013](#)).
- Assessment of the Eurosystem's LTROs:
 - macro GE approach ([Darracq-Paries and De Santis, 2013](#), [Cahn, Matheron and Sahuc, 2014](#)), micro approach on bailing out weak banks and carry-trade incentives ([Acharya and Steffen, 2015](#), [Drechsler et al., 2014](#)).

The 3-year LTROs: a large positive liquidity shock

- Unlimited provision of liquidity at 3-year maturity through repos (collateral constraint only)
- Announced on [Dec. 8, 2011](#), against backdrop of escalating Sovereign debt crisis. Two rounds:
 - [Dec 21, 2011](#): EUR 489.2 bns allotted to [523](#) banks (net injection: EUR 210 bns);
 - [Feb. 29, 2012](#): EUR 529.5 to [800](#) banks (net: EUR 311 bns).
 - Fears of [stigma](#) alleviated by Pres. Draghi's statement on [Feb. 9, 2012](#).
- Huge numbers: about 80% of euro area monetary base, 20% of domestic bank credit to firms, 11% of GDP as of end 2011.
- Low rates (expected ECB repo rate until maturity) compared to market conditions;
- Strong market impact [go to Fig. 1](#).

Had the LTROs a positive impact on credit supply?

- Not clear if you look at the macro dynamics of credit over 2010-2012
[go to Fig. 2](#)
- However, such a direct assessment is blurred by
 - lower credit demand by firms (depressed economic activity) [go to Fig. 3](#)
 - banks which tapped the LTRO facility the most may be special:
 - stressed access to funding and incentive to deleverage;
 - under or over-performing portfolio of firms.
- Assessing the impact of LTROs on credit therefore requires to control for the effects of:
 - firms' credit demand/risk profile;
 - banks' specific (risk) factors.
- detailed micro data required here!

- We merge four different sources of French individual data:
 - BDF Credit register data: credit exposures (drawn + undrawn) of a bank i to a firm j (all bilateral exposures $>$ EUR 25,000)
 - ACPR Bank supervisory data: (consolidated) bank balance sheet ratios (cut-off: June 2011)
 - Eurosystem Operations data: amount borrowed by each bank in the LTROs (and in other operations)
 - FIBEN: Firms' BDF credit risk rating / balance sheet for subset of firms

- We drop:
 - Small lenders: Banks with less than .1% of total credit to firms;
 - Belgian-French group Dexia: under deep restructuring in the Fall of 2011;
 - 5 (small) banks with a variation in total credit >50% over period;
 - Firms borrowing less than 25,000 EUR from selected banks as of Sept. 2011;
 - Outlier bilateral credit growth rates: below 2nd above 98th perc.
- We are then left with
 - 24 “banks” (89% of loans to firms, 91% of LTRO take-up), incl. all major French banking groups and 13 Foreign subsidiaries;
 - 1.172 million firms (79% total credit), among which 211,000 multibank firms (429,000 links and 57% of total bank credit to firms in France)

The impact of LTROs on credit supply

Empirical model: baseline

Baseline regression:

$$\Delta L_{ij} = \beta_0 + \beta_j + \beta_1 LTRO_i + Z_i' \gamma + \eta_{ij}, \quad (1)$$

- Dependent variable (at bank-firm level):
 - Growth rate (from Sept-2011 to Sept-2012, in logs) of credit from bank i to firm j (**intensive margin**);
 - Note: credit = loans + unused committed credit lines
- Independent variable of interest (at bank level):
 - Bank's j LTRO take-up **as a fraction of its total assets**.

The impact of LTROs on credit supply

Empirical model: baseline (2)

- Firm j 's fixed effect = controls for the firm's credit demand/risk;
- Banks choose how much they bid as a function of their characteristics Z_i : omitted variable bias if $\text{corr}(LTRO_i, Z_i) \neq 0$;
- Hence control for bank i 's (risk) characteristics (in 2011Q2, so pre-LTROs):
 - Size (log of total assets),
 - Ratios (baseline): capital, liquid assets, interbank liabilities,
 - Dummies: usual MRO user, foreign bank, public bank.
- NB: within-firm approach efficient if banks are not specialized lenders linked to otherwise "shocked" industrial sector / loan-specific demand.
 - Merely theoretical problem here (French universal banking model).

The impact of LTROs on credit supply

Empirical model: maturity effect

- LTROs were **special** because they were **Long-Term**.
- What are the respective roles of **maturity swap** vs **plain liquidity extension**?

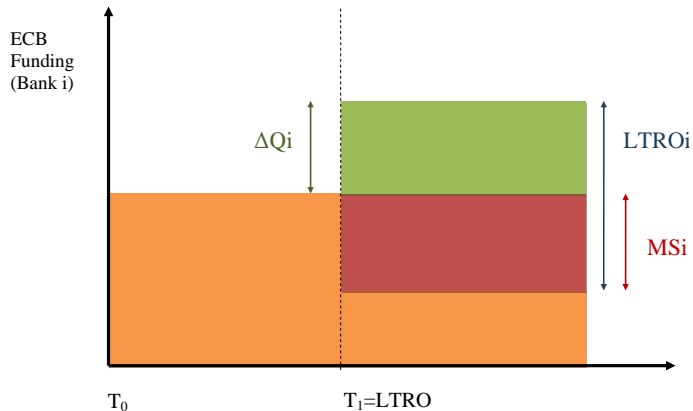
Let us define:

- total (net) *Quantitative Easing* over the period: ΔQ_i
- *Maturity Swap*: $MS_i = \min(LTRO_i - \Delta Q_i, 0)$ if $LTRO_i > 0$ (and $MS_i = 0$ if $LTRO_i = 0$).

Variant regression:

$$\Delta L_{ij} = \beta_j + \beta_{qe} \Delta Q_i + \beta_{ms} MS_i + Z_i' \gamma + \eta_{ij}. \quad (2)$$

LTRO: Quantitative easing vs maturity swap components



Selected 24 banking groups: descriptive statistics

Mean of balance sheet indicators by LTRO bidding behavior

	No LTRO	LTROs	LTRO 1	LTRO 2
	<i>N</i> = 14	<i>N</i> = 10	<i>N</i> = 6	<i>N</i> = 8
Total Assets (bns)	11.72	1,170.24	1,908.57	1,105.63
Loans	51.52	17.79	8.04	19.87
Total Credit Growth	-3.36	1.27	-3.77	2.08
Interbank Assets	25.05	10.29	14.24	8.30
Capital	7.94	8.11	4.83	9.20
Interbank Liabilities	43.70	14.62	13.58	14.86
LTRO	0.00	2.76	1.47	2.97
LTRO Maturity Swap	0.00	0.69	1.16	0.49
Quant. Easing	0.24	2.28	0.68	2.47
Nb of indiv. banks included	2.57	27.70	43.00	22.38

The impact of LTROs on bank credit supply to firms

Baseline results - selected sample of banks and **multibank** firms

	Total LTROs		Round 1	Round 2	Round 1
Bank LTRO	0.28*	0.60**	0.93***	0.05	
	(0.14)	(0.26)	(0.34)	(0.33)	
Maturity Swap					3.23***
					(0.93)
Quantitative Easing					-0.07
					(0.46)
Bank controls	No	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	428,594	428,594	428,594	428,594	428,594
R^2	0.53	0.54	0.54	0.54	0.54

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Standard errors are clustered at the bank*sector (NAF 1 digit) level (over 210 clusters). *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

LTRO 1 vs LTRO 2: Relief of stigma and opportunistic behaviour?

Mario Draghi, ECB Pdt: *As regards your second question, the 3-year facilities are there to be used. **There is no stigma** whatsoever attached to these facilities. This has to be understood by everybody. I would describe some of the statements made as “statements of virility”. [...] Some banks thought that it is far better for banks to fully access these facilities, unlike those that made these statements. So they saw no stigma. It is a business decision that should be presented as such. (Q&A, Press Conference, Feb. 9, 2012)*

Relief of stigma and opportunistic behaviour?

Determinants of LTRO bids by selected banks, first vs second round.

	Prob. of bid		LTRO/A.	
	LTRO1	LTRO2	LTRO1	LTRO2
Bank Capital	-0.17*	0.03	-0.28*	0.30*
	(0.09)	(0.04)	(0.14)	(0.16)
N	24	24	24	24
Pseudo R^2	0.15	0.02	0.12	0.05

Note. Columns (1-2): Probit (dependent variable: dummy variable = 1 if bank bid at the specified LTRO round); columns (3-4): Tobit (dependent variable: bank's take-up at the specified LTRO round, divided by this bank's total assets). Robust standard errors.

The impact of LTROs on credit supply

Economic significance

- Surplus of credit induced by the LTRO bid at bank i 's level:
$$XSL_i = .60 \times (LTRO / TA)_i \times L_i$$
- Total surplus, scaled by total LTRO take-up: $\sum XSL_i / \sum LTRO_i$
- Overall: **1 billion LTRO** led to a **95 million** increase in credit supply.

- Does the hypothesis of ex ante **parallel trends** hold?
 - Placebo regression on Sept. 2010-Sept. 2011
- Are the results robust to **additional bank controls**?
 - Composition of assets, **quality** of assets (share of ECB eligible loans)
 - Simultaneous **2011 EBA Capital Exercise** dragged down credit supply in euro area (cf. **Mésonnier and Monks, 2014**).
- Are the results robust to sample **limited to French banks**?
 - Foreign subsidiaries may benefit from LTRO uptakes of parent bank in home country.
 - Problem if also bid directly in France (may bias coefficient upward).

Robustness 1

Placebo regressions: one year before (over Sept. 2010-Sept. 2011)

	Total LTROs		Round 1	Round 2	Round 1
Bank LTRO	-0.52	-0.03	0.09	-0.14	
	(0.42)	(0.84)	(1.56)	(0.47)	
Maturity Swap					2.00
					(1.59)
Quantitative Easing					-0.64
					(1.79)
Bank controls	No	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	360,836	357,311	357,311	357,311	357,311
R^2	0.59	0.59	0.59	0.59	0.59

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2010 to September 2011 (in percent). Standard errors are clustered at the bank*sector (NAF 1 digit) level (over 210 clusters). *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Robustness 2

Adding bank balance sheet controls

Bank LTRO Round 1	0.98***	0.94***	0.91**	1.16***	1.10***
Bank Loans	-0.03*				
Bank Undrawn Commit.		-0.03			
Bank Eligib. Loans			-0.03		
Bank Securit. Portf.				-0.06	
Bank Deposits					0.03
Other bank controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	428,594	428,594	428,594	428,594	428,594
R^2	0.54	0.54	0.54	0.54	0.54

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Standard errors are clustered at the bank*sector (NAF 1 digit) level (over 210 clusters). *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Robustness 3

Controlling for the EBA Capital exercise of 2011 and sample limited to French groups

	All banks		French banks	
Bank LTRO Round 1	2.27***		1.29***	
Maturity Swap		3.16***		5.88**
Quant. Easing		0.27		0.43
EBA Capital Shortfall	-2.23**	-0.51		
Bank Bond Rollover			-0.86***	-0.86***
Other bank controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
N	428,594	428,594	405,509	405,509
R^2	0.54	0.54	0.56	0.56

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Standard errors are clustered at the bank*sector (NAF 1 digit) level. *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Did all types of firms benefit from the increased supply?

- We split the sample into small, intermediate, large and very large borrowers
 - 'Very Small': below the median (total bank credit $L < \text{EUR } 136,000$)
 - 'Small': between sixth to ninth deciles
 - 'Intermediate': last decile excluding the top 1% ($L > \text{EUR } 0.7 \text{ mns}$), roughly 15% of total bank credit to firms
 - 'Large': top 1% ($L > \text{EUR } 7.5 \text{ mns}$), roughly 58% of total bank credit to firms
 - *NB: correlation between borrowing size and asset size (when available) is 0.74.*
- Robustness: firms sorted according to size of staff (cutoffs at 10, 50, 250).
- Also: probability of maintaining existing exposure increased, but only for interm. and large firms.

Descriptive stats of firms by (borrowing) size buckets

Median of characteristics by groupings - sample of multibank firms

	Small	Interm.	Large	Very large
<u>All multibank firms (211,209)</u>				
Nb of firms	29,325	110,374	61,307	10,203
Firm Total Credit	100	311	1,451	16,844
Firm Total Credit Growth	-6.56	-6.73	-5.34	-0.98
Firm Nb of Banks (incl. non-selected)	2.00	2.00	3.00	4.00
<u>Multibank firms with balance sheet information (36,750)</u>				
Nb of firms	3,366	15,861	14,988	2,641
Firm Total Credit	97	347	1,605	15,885
Firm Size	954	1,519	5,724	58,221
Firm Nb Employees	12.00	15.50	33.50	102.00

Did all firms benefit from the increased supply?

	All	Very Small	Small	Interm.	Large
Bank LTRO Round 1	0.93*** (0.34)	0.41 (0.52)	0.31 (0.40)	0.99** (0.40)	3.30*** (0.51)
Bank controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	428,594	44,372	208,630	143,749	31,843
R^2	0.54	0.71	0.56	0.46	0.40

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Firms sorted into size buckets according to the distribution of total bank credit across firms in September 2011. Standard errors are clustered at the bank*sector (NAF 1 digit) level. *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Did all firms benefit from the increased supply? (firms sorted by size of staff)

	All	$N < 10$	$10 < N < 50$	$50 < N < 250$	$N > 250$
Bank LTRO Round 1	0.93*** (0.34)	0.71** (0.32)	2.25*** (0.51)	2.73*** (0.83)	3.08*** (1.12)
Bank controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	428,594	44,372	208,630	143,749	31,843
R^2	0.54	0.71	0.56	0.46	0.40

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Firms sorted into size buckets according to the size of their staff as of end 2010. Standard errors are clustered at the bank*sector (NAF 1 digit) level. *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Did all firms benefit from the increased supply?

Another look: LTROs and probability of staying connected

	All	Very Small	Small	Interm.	Large
Bank LTRO Round 1	0.01 (0.01)	-0.00 (0.01)	0.00 (0.01)	0.01** (0.00)	0.01** (0.01)
Bank controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	526,672	67,778	252,489	168,643	37,212
R^2	0.52	0.54	0.50	0.45	0.43

Note. Linear probability regressions. Dependent variable: dummy variable=1 if the level of committed credit volume for a selected firm-bank pair is strictly positive in Sept. 2012. Multibank firms only. Firms sorted into size buckets according to the distribution of total bank credit across firms in September 2011. Standard errors are clustered at the bank*sector (NAF 1 digit) level. *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Did some other characteristics of borrowing firms matter?

(X)	Eligib.	ACC	Nb Bk	Relat.	Size	Profit.	Sound.
	All firms				Firms with BS info		
LTRO 1	0.93** (0.38)	0.72** (0.31)	-0.45 (0.50)	2.99*** (0.45)	2.93* (1.66)	2.24*** (0.37)	2.23*** (0.36)
X*LTRO 1	-0.01 (0.53)	1.89*** (0.45)	0.47*** (0.15)	-2.91*** (0.33)	-0.08 (0.18)	0.01** (0.00)	0.00 (0.01)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cont's	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	428,594	428,594	428,594	428,594	81,620	81,502	81,620
R ²	0.54	0.54	0.54	0.54	0.51	0.51	0.51

Note. OLS regressions. Multibank firms only. Dependent variable: change in the (log) level of credit volume for each selected firm-bank pair over the period from September 2011 to September 2012 (in percent). Firms sorted into size buckets according to the distribution of total bank credit across firms in September 2011. Standard errors are clustered at the bank*sector (NAF 1 digit) level. *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Was the stimulus mitigated by substitution effects at the level of borrowing firms?

Same sample of multibank firms, collapsed at firm level - Sector controls

	Total of two LTRO rounds				LTRO 1	LTRO 2
Bank LTRO	0.32	0.39**	0.40*	0.30	0.75**	-0.02
Av. Relationship Age			-1.34	-1.36	-1.34	-1.37
Eligibility			1.39***	1.32***	1.33***	1.30***
ACC			2.11***	2.08***	2.09***	2.06***
F. Borr. Size	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	No	Yes	Yes	Yes	Yes	Yes
Bank controls	No	No	No	Yes	Yes	Yes
N	182,248	182,248	182,248	182,248	182,248	182,248
R^2	0.01	0.06	0.06	0.06	0.06	0.06

Note. OLS regressions. Dependent variable: change in the (log) level of credit volume for each selected firm over the period from September 2011 to September 2012 (in percent). Bank LTRO: weighted average of LTRO take-up ratios of lenders to a given firm, weighted by the share of each bank in total borrowing by this firm. Sector FE relate to detailed industry level (NAF 5 digits). Standard errors are clustered at the broad industry level (2 digits). *, ** and *** denote significant coefficients at the 10, 5 and 1 percent levels respectively.

Conclusion

*“We do think that this decision has **at least** prevented a credit contraction that would have been more serious, far more serious.” (Mario Draghi, ECB Press Conference, Jan. 12, 2012)*

- Our results confirm that the 3Y-LTROs have mitigated the contraction of bank credit, at least in France.
- First round of LTROs effective: bidding banks at round 1 were on average more constrained as stigma was a threat.
- Within the first round, the maturity swap worked, not so much the QE per se: securing banks' long-term funding is key.
- Smaller firms did not benefit from the increased supply of credit: case for targeted measures? (cf. T-LTROs)
- No support for concerns about evergreening

- Our results are likely to underestimate total impact of the measure:
- No data on loan applications: impact on intensive margin out of reach
- LTROs eased bank funding constraints across the board:
 - e.g. Acharya-Steffens (2014): LTROs had a positive impact on demand for sovereigns \Rightarrow lower sovereign spreads (\Rightarrow positive valuation effect on bank holdings and capital).
- Macroeconomic positive feedback loop: more credits \Rightarrow higher aggregate demand \Rightarrow more credits (cf. e.g. Cahn, Matheron and Sahuc, 2014).

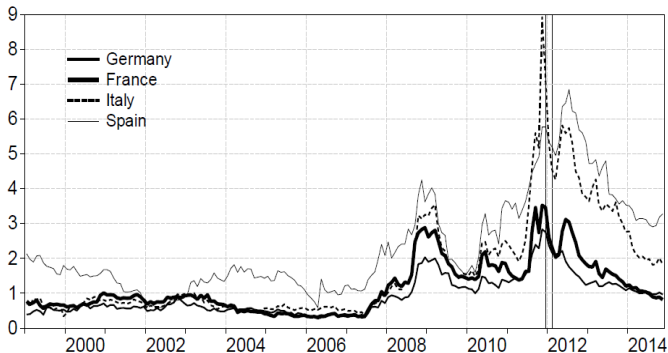
Appendix 1

Selected firms - descriptive statistics. Source: Credit Register as of Sept. 2011

	mean	p50	sd	p10	p90
<u>All firms</u> ($N \approx 1,172,000$)					
Total Credit Growth	-5.71	-8.00	30.21	-31.30	21.55
<u>Multibank firms</u> ($N = 211,209$)					
Total Credit Growth	2.82	-5.94	41.85	-30.54	44.63
Total Credit (000)	4,561.44	417.00	97,457.69	116.00	3,242.00
ECB Eligibility Status	0.14	0.00	0.34	0.00	1.00
Relationship Age > 3y	0.76	1.00	0.43	0.00	1.00
Nb of Banks	2.41	2.00	0.82	2.00	3.00
Firm with BS info	0.17	0.00	0.38	0.00	1.00

Bond spreads for euro-area banks

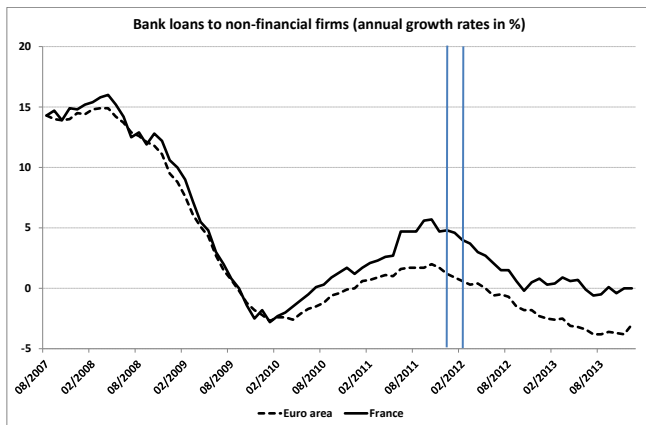
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Note. This figure shows for each country the average spread of bank bonds towards the German Bund. Aggregate spreads are computed from individual bond data following the methodology in Gilchrist and Mojon (2014). Vertical lines stand for the two rounds of the LTROs.

Eurosystem's LTROS and bank credit to firms: macro view

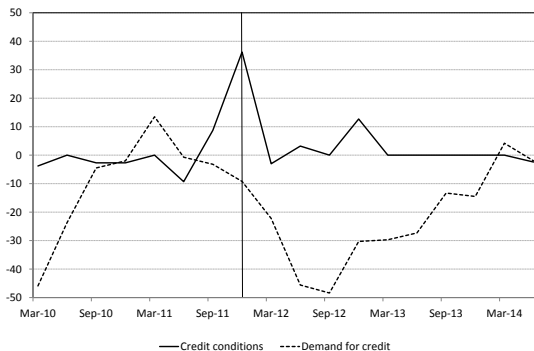
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Note. This figure shows for France and the euro area the annual rate of growth of loans of domestic MFIs to non-financial firms. Vertical lines stand for the two rounds of the LTROs.

BLS France: Credit supply and demand, non-financial corporates

back



Note. This figure shows the index of credit conditions for bank lending to non-financial firms (solid line) and the index for credit demand by non-financial firms (dashed line), as taken from the Eurosystem's Bank Lending Survey for France. Positive numbers denote respectively tighter supply and stronger demand. End-of-quarter figures refer to perceived changes over the last three months.