The Effect of Central Bank Liquidity Injections on Bank Credit Supply

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Research question

- During recent crises sources of funding dried up dramatically
- Central banks (Fed, ECB, BoE) provided very large amounts of liquidity to avoid a credit crunch
- Theory behind the intervention: negative shock causes credit contraction and Central Bank illimited liquidity provision restores credit supply

- In this paper we explore CB effectiveness in restoring credit flows

How

And we do that

- looking at Italian banks, that were hit by a severe funding shock
- around the ECB long-term refinancing operations of 2011-12
- largest liquidity provision in history (1 trillion €)
- assessing its impact on credit supply to Italian firms
- Unique borrower level dataset from Credit register

In a nutshell, three findings...

Preview of Findings

1. **LTROs Restore Bank Credit Supply**
   Banks that suffer large dry-ups reduce credit supply and then increase it again after LTROs

2. **LTROs also Encourage Reaching for Yield**
   Liquidity attracts all banks (pooling equilibrium), but the impact on credit is transmitted by those that were hit by the negative shock.

3. **CB Intervention Design is Key**
   Banks that need liquidity have scarce collateral. Unlimited liquidity provision is not enough: features of collateral policy matter

Outline

1) **Related literature**
2) Setting and Data
3) Effect on Bank Credit Supply
4) Transmission Channel
5) Summing up

Funding shock and credit

This paper relates to two strands of literature.

1) effect of negative funding shocks on bank credit supply:

- seminal works of (Bernanke and Blinder (1988), Bernanke and Gertler (1989))
- empirical applications with within borrowers estimators ((Khwaja and Mian (2008), Paravisini (2008), Chernenko and Sunderam (2014), Schnabl (2012), Iyer et al. (2014))
- recent lit on pass-through of sovereign credit risk on intermediated credit: (Popov and Van Horen (2015), De Marco (2015), Cingano et al. (2013), Bofondi et al. (2013), Acharya et al. (2015a))

MP transmission

2) the transmission of monetary policy to credit supply:

- firms financing and consumer credit (Jimenez et al. (2012), Jimenez et al. (2014) , Agarwal et al. (2015))
- impact of unconventional monetary policy (Chodorow-Reich (2014a), Di Maggio et al. (2015))
- the effect of ECB interventions during the sovereign debt crisis (Casiraghi et al. (2013), van der Kwaak (2015), Vissing-Jorgensen et al. (2014), Crosignani et al. (2015), Andrade et al. (2015), Garcia-Posada and Marchetti (2015), Garcia-de Andoain et al. (2016))

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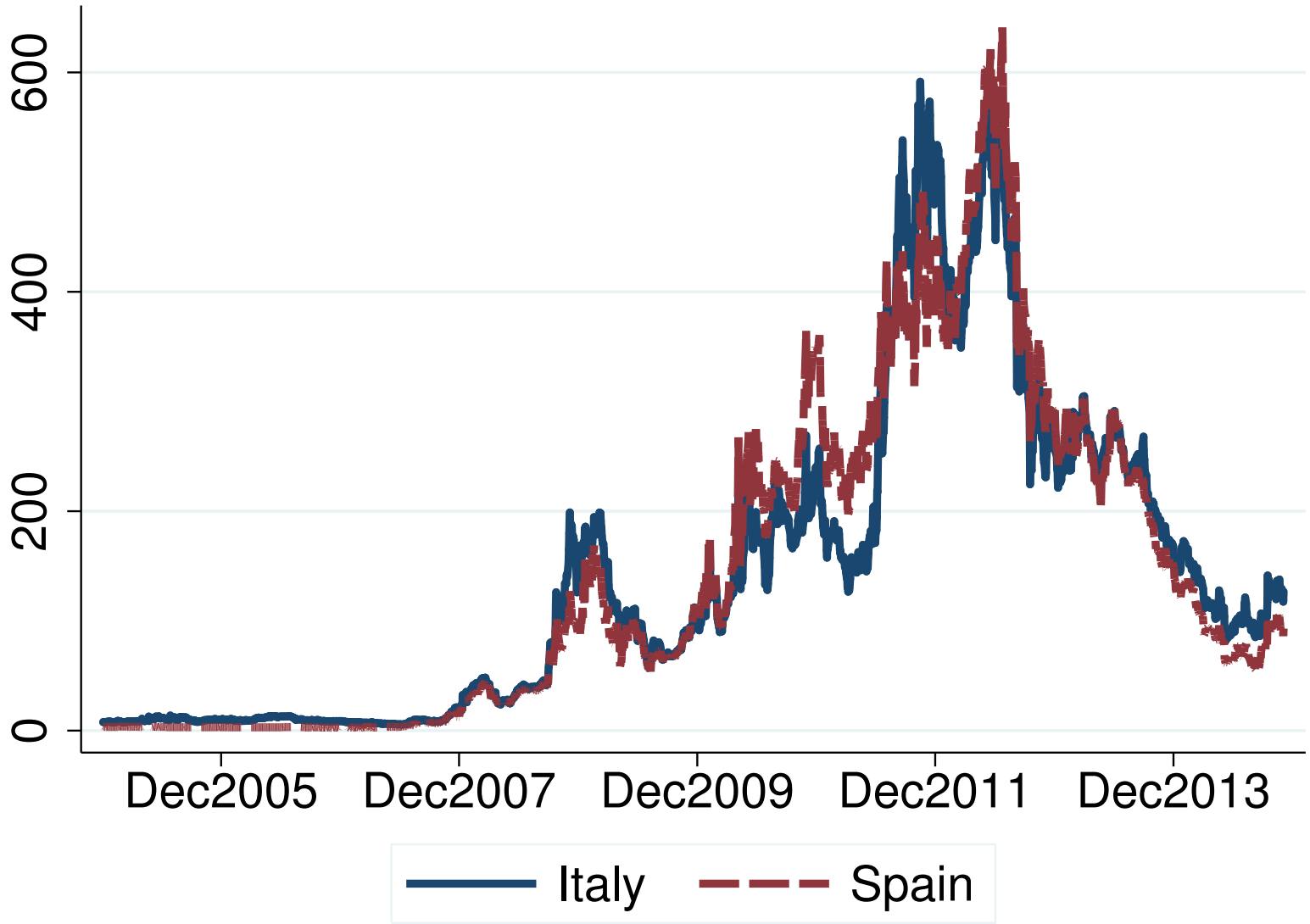
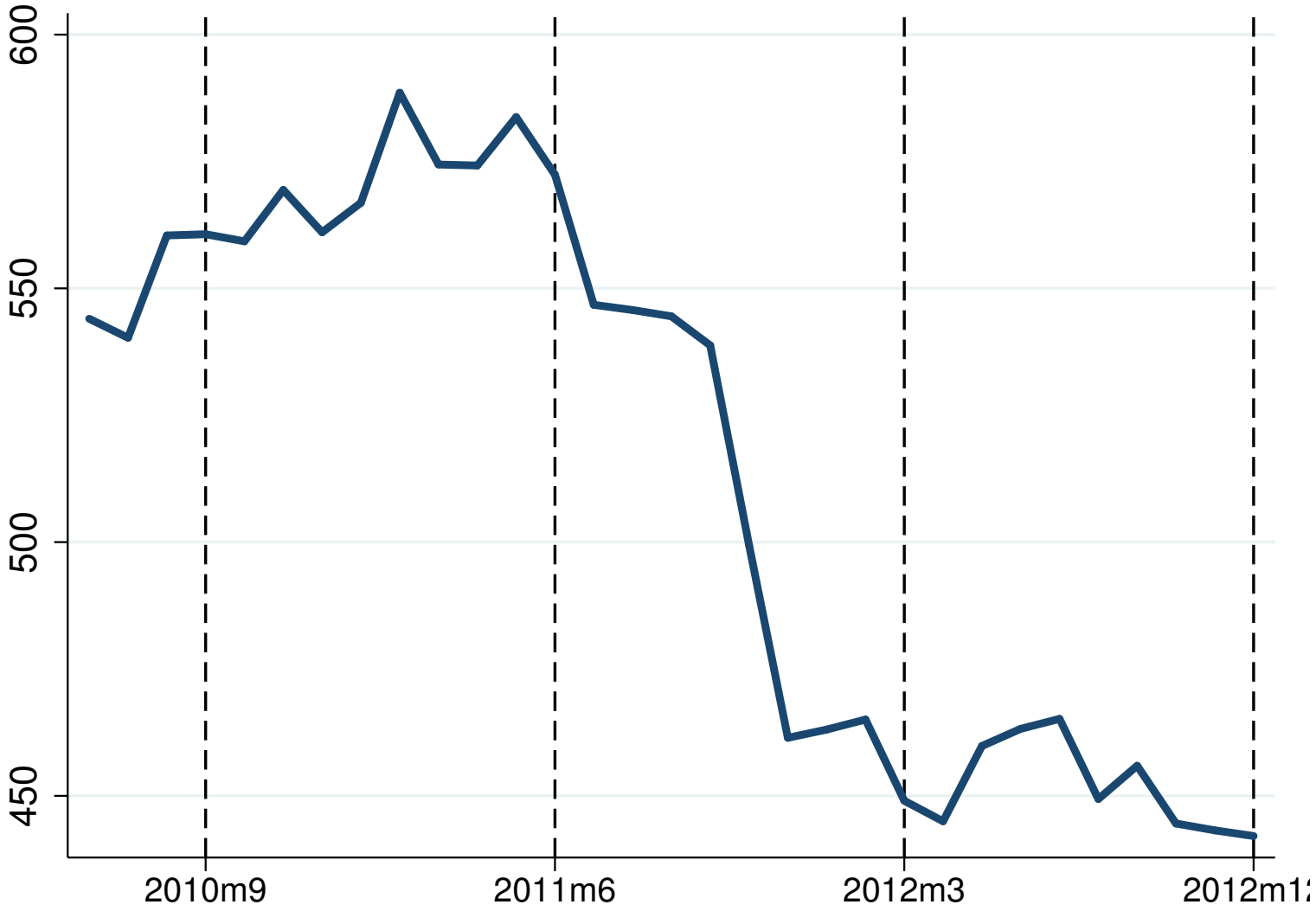
Rising Sovereign Credit Risk (CDS Spreads)



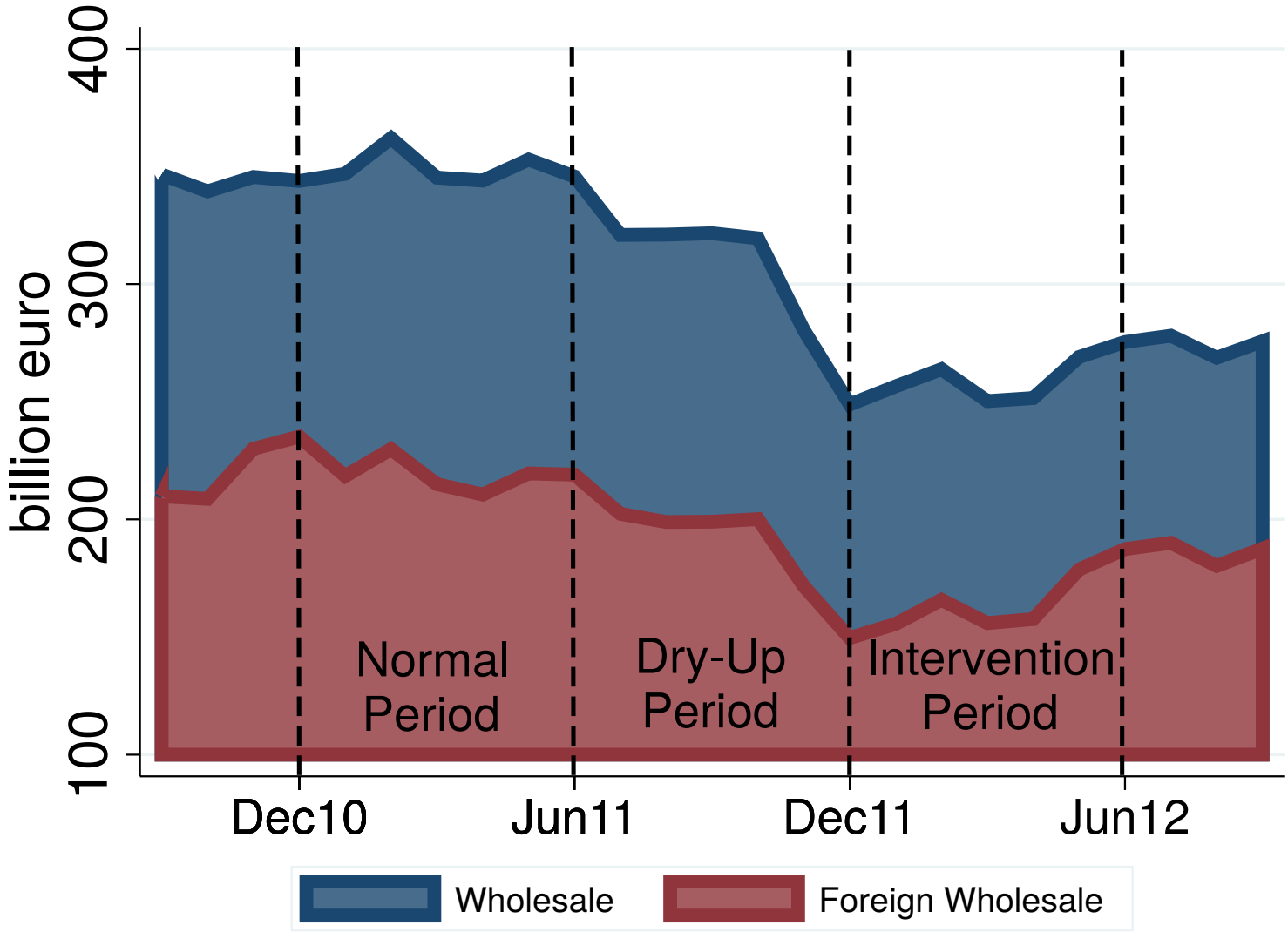
Italian Banks Are Hit by the Dry-up

Funding of Italian Banks (bn EUR)



...Entirely Driven by Foreign Wholesale Funds

Wholesale funding of Italian Banks (bn EUR)



Dec 2011: ECB injects 1 trillion €in Eurozone Banks

- 3-Year Long Term Refinancing Operation (LTRO). Simple design
  - 3-year maturity collateralized cash loans
  - Banks can choose how much to obtain in two allotments
  - Low interest rates (average MROs rates)
  - Need to pledge collateral (government bonds, ABS,...)

- Italy is a good laboratory for the addressing this question
  - Italian banks severely hit by the sovereign crisis
  - Largest liquidity injection in history and Italian banks second largest users (total uptake of 300 bn €)
  - Richness of Italian dataset

Data on the Entire Intermediation Chain

- ECB loans to banks
  - Bank-level borrowing at ECB
- Bank Characteristics
  - Detailed composition of funding
  - Security-level holdings and collateral use
- Bank Loans to Firms
  - *All* outstanding loans above 30,000 €(Credit Registry)
  - Term loans, credit lines, trade credit
- Firm Characteristics
  - Large subset (55%) of firms

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Two empirical challenges

In the ideal setting

1. there are no confounding factors of credit quantities and the borrower-bank match is random
2. central bank liquidity injections are also randomly assigned to banks.

In fact

1. credit equilibrium quantities not only depend on supply, but also on demand and borrowers' characteristics; furthermore borrowers might be heterogeneously distributed across lenders
2. the uptakes of liquidity are not randomly assigned to banks, as these *can choose* whether and how much they obtain

Addressing them

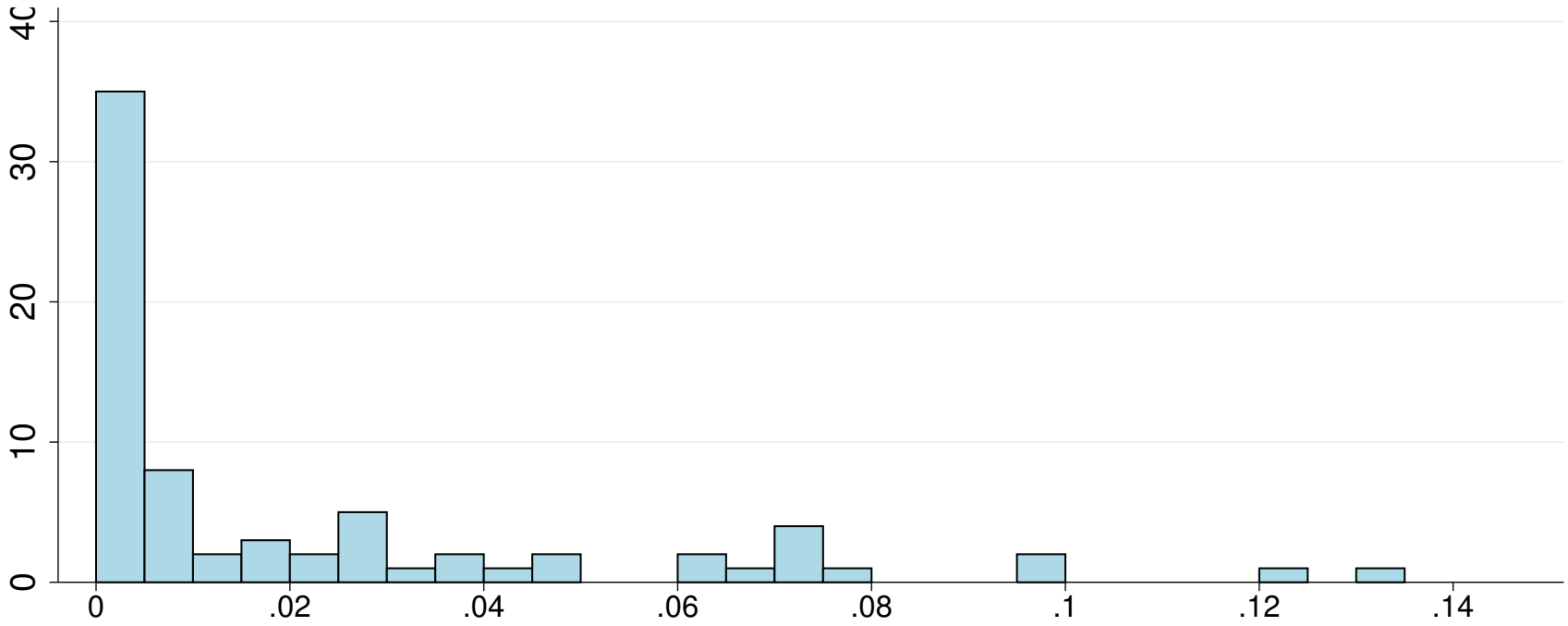
1. **Compare credit growth from different banks to the same firm**, as in Khwaja Mian (2008)

2. **Use bank heterogeneity in run exposure pre-crisis**, (as in Iyer et al. (2014)

$$Exposure_j = \frac{ForeignWholesale_{j,Jun11}}{Assets_{j,Jun11}}$$

- Measured before the run (June 2011)
- Splitting the banks into "more affected" and "less affected" based on the median
- Differential exposure to both *run* and *CB intervention*

Exposure to the Run



75% of loans belong to banks with exposure $> 5\%$

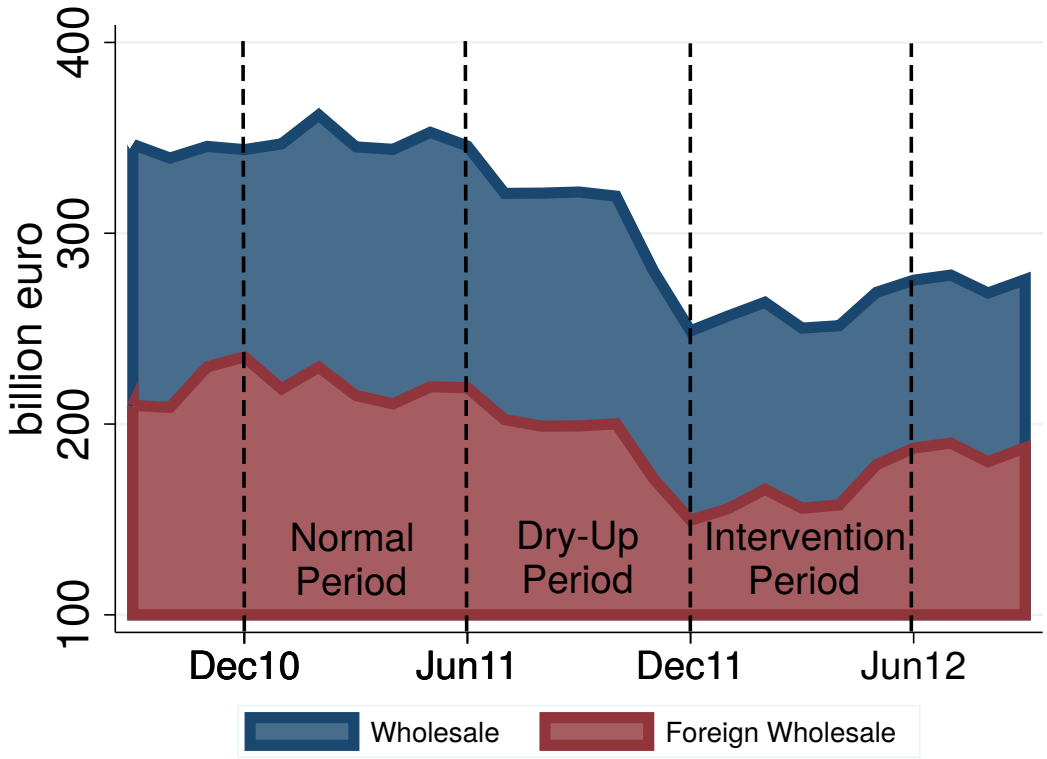
Summary Stats: Exposed and Non-Exposed Banks

	Unit	Exposed	Non-Exposed
Total Assets	billion euros	11.0	1.3
Leverage	Units	13.2	10.8
Tier 1 Ratio	Units	9.1	11.4
Risk-Weighted Assets	% Assets	71.2	68.0
Nonperforming Loans	% Loans	8.6	8.7
Private Credit	% Assets	68.9	70.1
Securities	% Assets	14.2	14.0
Cash Reserves	% Assets	0.4	0.5
ROA	Profits/Assets	0.2	0.1
Central Bank Borrowing	% Assets	1.8	0.0
Household Deposits	% Assets	24.7	34.9
Wholesale Funding	% Assets	12.2	1.6
Bond Financing	% Assets	22.8	20.2

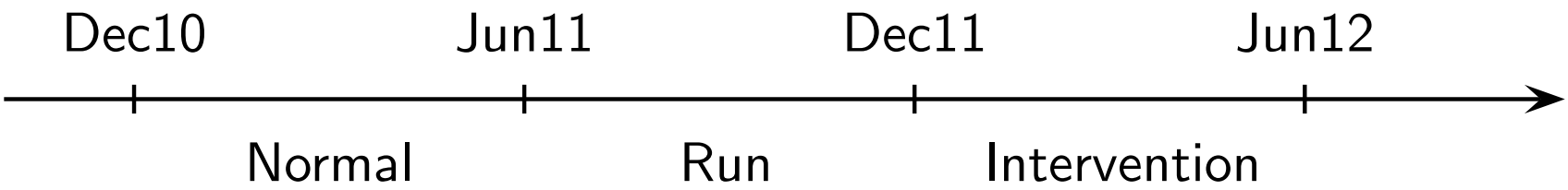
$\Rightarrow$ Need to control for bank characteristics

Three periods

Based on the evolution of bank funding we identify 3 periods



for two comparisons (and questions)



We compare bank credit supply between

1) the *normal* and the *dry-up* period to assess the impact of the shock
2) the *dry-up* and the *intervention* period to assess the effectiveness of the intervention

Baseline Specification

$$\Delta Log(Credit_{ijt}) = \alpha + \mu_{it} + \gamma_{ij} + \phi' X_{ijt} + \beta_1 Expos_j \times \mathbb{I}^{Run,Int} + \beta_2 Expos_j \times \mathbb{I}^{Int} + \epsilon_{ijt}$$

- *Credit*: credit granted
- Time dummies
  - $\mathbb{I}^{Run,Int}$ equal to one in the intervention and run periods
  - $\mathbb{I}^{Int}$ equal to one in the intervention period
- Fixed Effects
  - Bank-Firm γ_{ij}
  - Borrower-Time μ_{it}
- Controls X_{ijt}

Effect on Bank Credit Supply

$$\Delta Log(Credit_{ijt}) = \alpha + \mu_{it} + \gamma_{ij} + \phi' X_{ijt} + \beta_1 Expos_j \times \mathbb{I}^{Run,Int} + \beta_2 Expos_j \times \mathbb{I}^{Int} + \epsilon_{ijt}$$

	ΔCreditGranted				
$Exposure_j \times \mathbb{I}_{DU,LTRO}$	-0.127***	-0.129***	-0.128***	-0.132***	-0.114***
	(0.045)	(0.037)	(0.037)	(0.040)	(0.031)
$Exposure_j \times \mathbb{I}_{LTRO}$	0.247***	0.251***	0.245***	0.172***	0.115**
	(0.061)	(0.044)	(0.043)	(0.043)	(0.053)
Time FE	✓				
Bank FE	✓	✓	✓		
Firm-Time FE		✓	✓	✓	✓
Relationship Controls			✓	✓	✓
Bank-Firm FE				✓	✓
Bal. Sheet Controls					✓
N	2,322,142	2,322,142	2,322,142	2,171,749	2,171,749
R^2	0.005	0.380	0.394	0.700	0.701

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4) **Transmission Channel**
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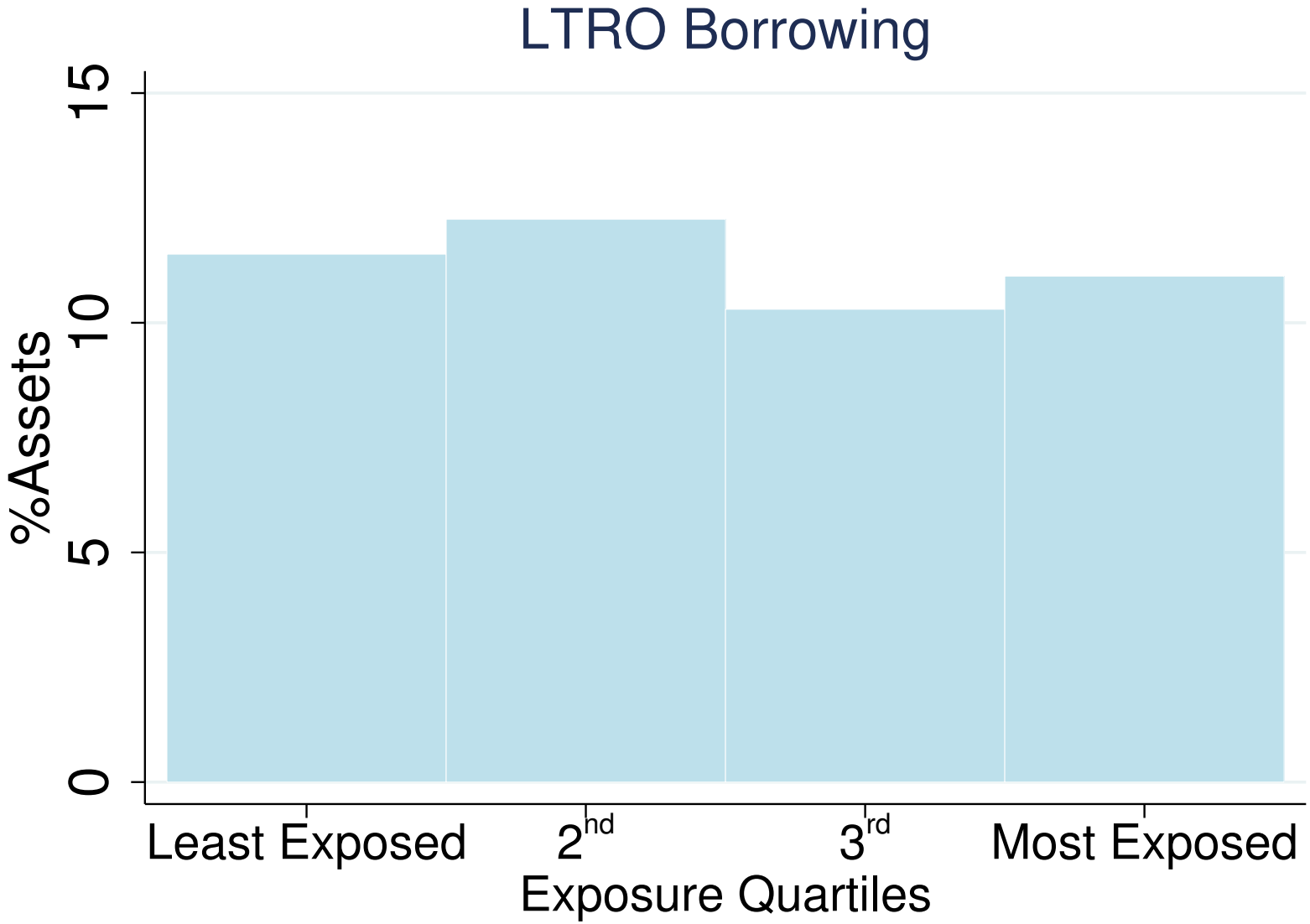
All Banks Take Advantage of ECB Liquidity

- The LTRO successfully attracts many banks
  - ECB liquidity is cheap compared to the private market
  - Our sample banks borrow €181.5 billion
  - Median uptake is 10% of total assets

- Little heterogeneity in banks' uptakes of the ECB liquidity

$\Rightarrow$ Bank exposure to the dry-up is not a valid instrument for the LTRO uptakes.

All Banks Borrow ≈ 10% of Total Assets



Reconciling our Findings

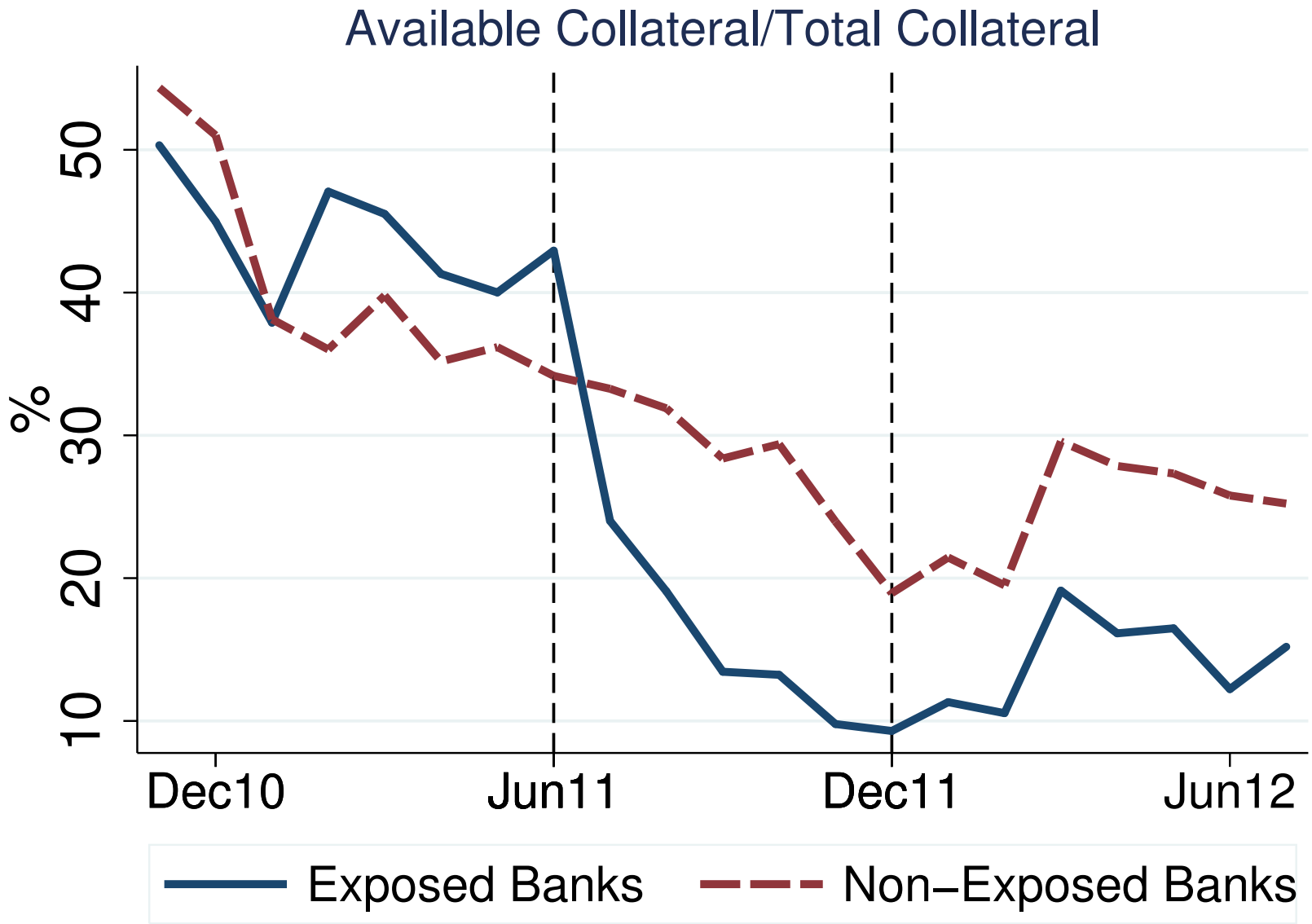
- Need to reconcile two findings:
  1) Exposed banks restore their credit supply after the LTRO
  2) *All* banks take advantage of the attractive ECB loans
- Exploit regulatory intervention by the Italian government
  - Govt-guaranteed assets are eligible collateral at the ECB
  - Dec11: Govt offers a guarantee on securities for a fee
  - Banks can "manufacture" collateral
- Large use of the government program
  - 28 banks create 102.8 bn euros of collateral
  - Govt-guaranteed collateral backs 57% of total LTRO loans
  - Exposed banks are the largest users (1Q 68% Vs. 4Q 17%)

Exposed Banks Use the Govt Guarantee Program

$$\Delta Uptake_j = \alpha + \beta Exposure_{j,Jun11} + \mu X_{j,Jun11} + \epsilon_j$$

	$Uptake^{Total}$	$Uptake^{GovtGuarantee}$
$Exposure_{Jun11}$	-0.164	0.236**
	(0.197)	(0.101)
LEV_{Jun11}	0.901***	-0.000
	(0.284)	(0.146)
ROA_{Jun11}	0.093**	-0.024
	(0.041)	(0.021)
$T1R_{Jun11}$	0.636***	-0.191*
	(0.220)	(0.113)
NPL_{Jun11}	0.071	0.066
	(0.247)	(0.127)
$Large_{Jun11}$	-7.628*	0.042
	(4.312)	(2.215)
N	48	48
R^2	0.395	0.228

Intuition: Erosion of Collateral During Dry-Up

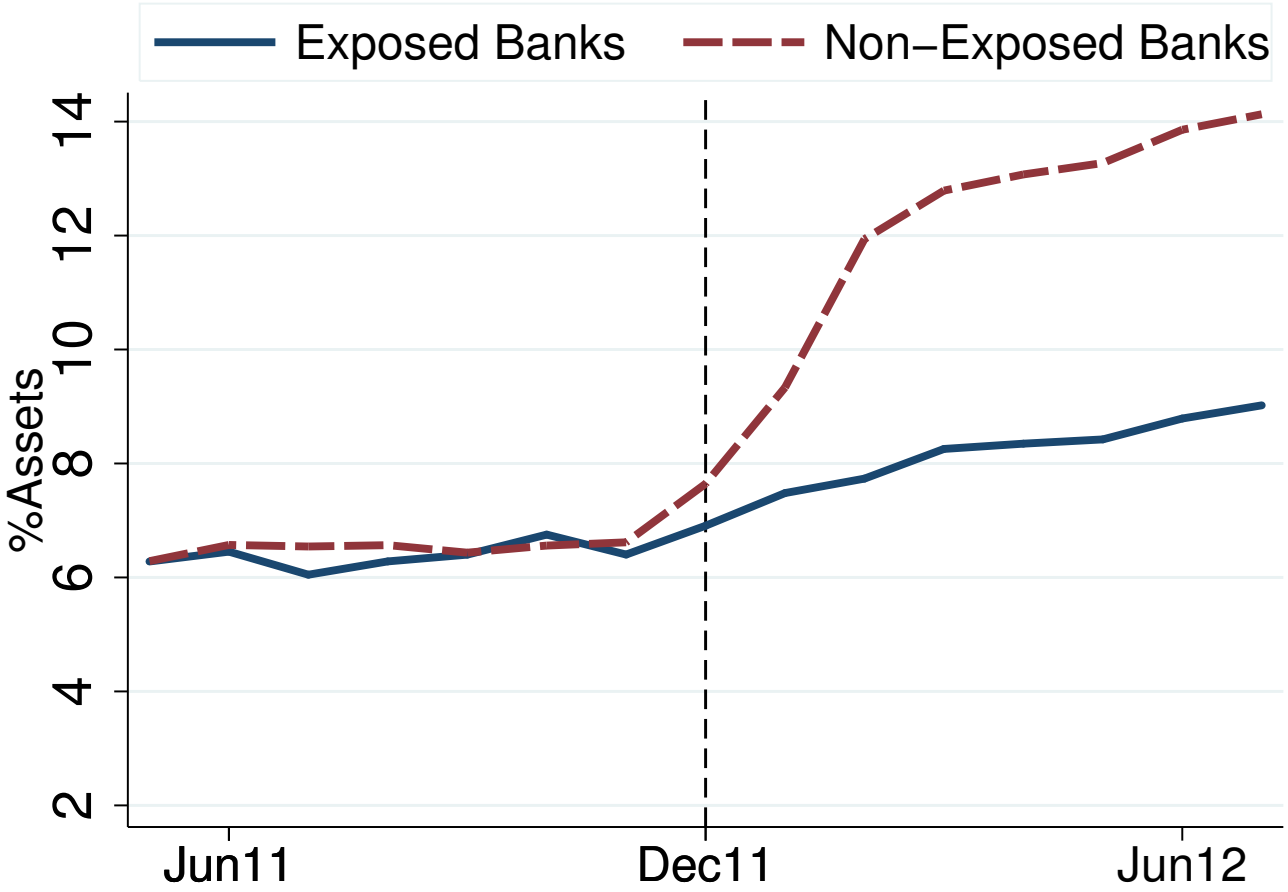


1) Transmission to Bank Private Credit

$$\Delta CreditGranted_{ijt} = \alpha + \beta Uptake_j \times \mathbb{I}_{LTRO} + \mu_{it} + \gamma_{ij} + \phi' X_{jt} + \epsilon_{ijt}$$

	$\Delta CreditGranted$		
$Uptake^{Total} \times \mathbb{I}_{LTRO}$	-0.042		
	(0.144)		
$Uptake^{GovtGuarantee} \times \mathbb{I}_{LTRO}$		0.249**	
		(0.122)	
$Uptake^{StandardCollateral} \times \mathbb{I}_{LTRO}$			-0.269*
			(0.142)
Bank-Firm FE	✓	✓	✓
Firm-Time FE	✓	✓	✓
Bal. Sheet Controls	✓	✓	✓
N	1,381,420	1,381,420	1,381,420
R^2	0.655	0.655	0.655

2) Transmission to Holdings of Government Bonds



- Of total €181.5 bn: €22.6 bn to firms and €82.7 bn in govt bonds
- €1 to exposed banks: €0.13 to firms and €0.44 in govt bonds
- €1 to non-exposed banks: €0 to firms and €0.83 in govt bonds

Transmission to Government Bond Holdings

$$Govt_{jt} = \alpha + \gamma_j + \eta_t + \beta Exposure_{j,Jun11} \times \mathbb{I}_{LTRO} + \Gamma_{jt} + \epsilon_{jt}$$

	$Govt$	$Govt^{Domestic}$	$Govt^{GIIPS}$	$Govt^{GIPS}$	$Govt^{Core}$
$Exposure_{Jun11} \times \mathbb{I}_{LTRO}$	-0.169**	-0.169**	-0.170**	-0.001	-0.004
	(0.072)	(0.077)	(0.076)	(0.004)	(0.004)
$LEV_{Jun11} \times \mathbb{I}_{LTRO}$	0.033	0.036	0.032	-0.005	0.006*
	(0.111)	(0.114)	(0.113)	(0.003)	(0.003)
$ROA_{Jun11} \times \mathbb{I}_{LTRO}$	-1.583	-1.532	-1.641	-0.108	0.012
	(1.724)	(1.756)	(1.741)	(0.097)	(0.054)
$T1R_{Jun11} \times \mathbb{I}_{LTRO}$	0.087***	0.088***	0.086***	-0.001	0.001
	(0.027)	(0.027)	(0.027)	(0.001)	(0.002)
$NPL_{Jun11} \times \mathbb{I}_{LTRO}$	2.839	3.088	3.022	-0.066	-0.112
	(7.574)	(7.560)	(7.542)	(0.083)	(0.117)
$Large_{Jun11} \times \mathbb{I}_{LTRO}$	-0.655	-0.623	-0.589	0.034	-0.017
	(0.827)	(0.877)	(0.854)	(0.055)	(0.019)
Bank FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
N	949	949	949	949	949
R^2	0.866	0.860	0.861	0.606	0.645

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Are Firms Affected?

- Firms affected by the dry-up if they cannot switch lenders
- Firms might not benefit from restoration of credit supply
  - Asymmetric information, slow-moving capital
- Collapse data set at the firm-time level and compute firm indirect exposure to the dry-up

$$\widetilde{Exposure}_{i,Jun11} = \frac{\sum_j Exposure_{j,Jun11} CreditDrawn_{ij,Jun11}}{\sum_j CreditDrawn_{ij,Jun11}}$$

- Estimate firm-level regression

$$\Delta CreditDrawn_{it} = \alpha + \beta_1 \widetilde{Exposure}_{i,Jun11} \times \mathbb{I}_{DU,LTRO} + \beta_2 \widetilde{Exposure}_{i,Jun11} \times \mathbb{I}_{LTRO} + \phi' \Gamma_{it} + \eta_t + \chi_i + \epsilon_{it}$$

Counterfactual Exercise

- **With no LTRO bank credit** -5.6% **instead of observed** -3.6%
- **Dry-up caused a bank credit contraction of** -3.7%

Follow Chodorow-Reich (2014):

1) Estimate firm-time FEs $\hat{\mu}_{it}$ from baseline specification
2) Calculate firm indirect exposure $\widetilde{Exposure}_{i,Jun11}$
3) Estimate firm-level regression plugging FEs $\hat{\mu}_{it}$
4) Use estimated coefficients to predict loan growth
5) Compare world with and without ECB (partial eqm)

Final Thoughts

- "Central banks should require good quality collateral"
  - Banks hit by the run are collateral constrained
  - Italian government guarantee: fiscal side of the intervention

  Trade-off: moral hazard vs restoration of bank credit

- Loan Maturity
  - ECB was providing short-term liquidity before Dec 2011
  - Banks were liquid, but facing large rollover risk

  Liquidity loan maturity matters for bank rollover risk