The Effects of Liquidity Regulation on Bank Demand in Monetary Policy Operations

Marcelo Rezende, Mary-Frances Styczynski, and Cindy Vojtech[1]

Federal Reserve Board

[1] The views expressed herein are our own and do not necessarily reflect those of the Board of Governors or the staff of the Federal Reserve System.

Motivation

- Academics and policymakers have argued that liquidity regulation may affect bank behavior in monetary policy operations.
- As far as we know, no empirical evidence of this effect.
- We examine the effects of a liquidity requirement on bank behavior in one monetary policy tool.

We Attempt to Fill This Gap

- We estimate the effects of the Liquidity Coverage Ratio **(LCR)** on the participation of banks in Term Deposit Facility **(TDF)** operations.

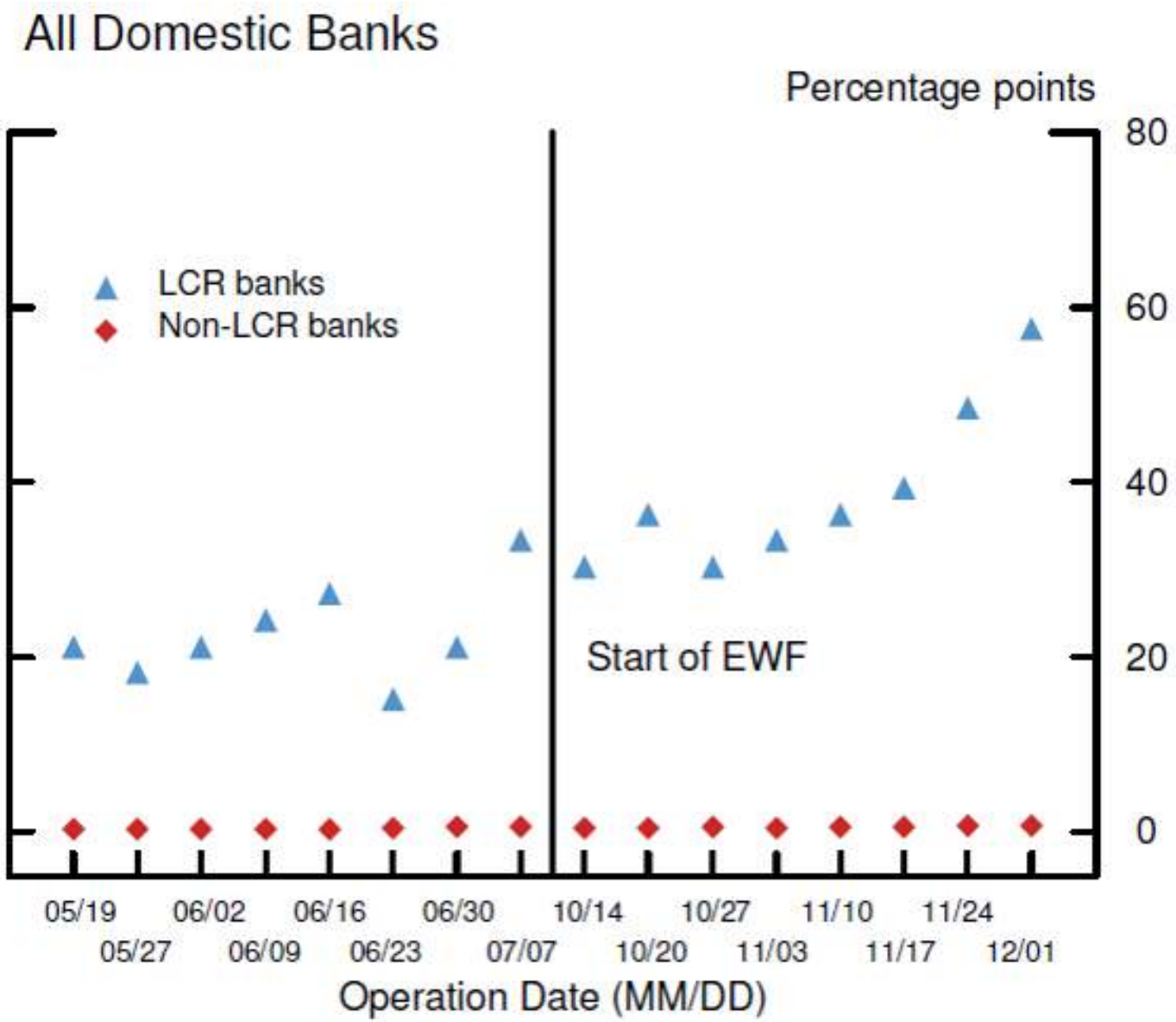
$$\text{bank } i\text{'s LCR} = \frac{\text{high-quality liquid assets}_i}{\text{projected net cash outflow over 30 days}_i}$$

- Excess reserves qualify as high-quality liquid assets **(HQLA)**.
- Term deposits are deducted from excess reserves.
- Therefore, the LCR may lower participation in TDF operations.
- Challenge: LCR coverage and TDF participation are endogenous.

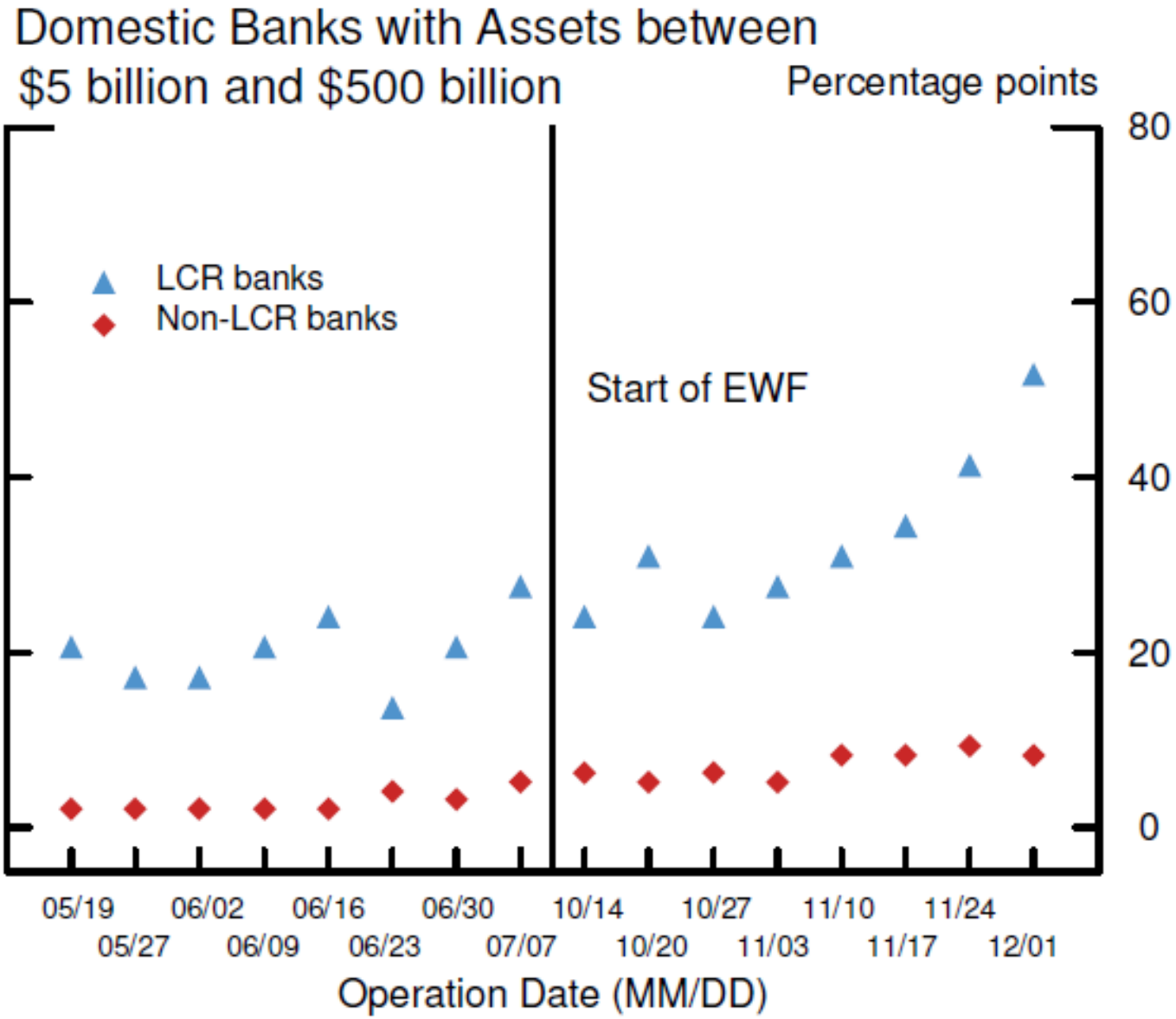
Empirical Strategy: Difference-in-Differences Methodology

- We use variation in LCR coverage.
- We also use variation in a key characteristic of TDF operations, the Early Withdrawl Feature **(EWF)**.
- The EWF allows banks to withdraw term deposits before maturity, making those deposits qualify as HQLA.
- Thus, banks covered by the LCR may be more interested in participating in TDF operations with an EWF.

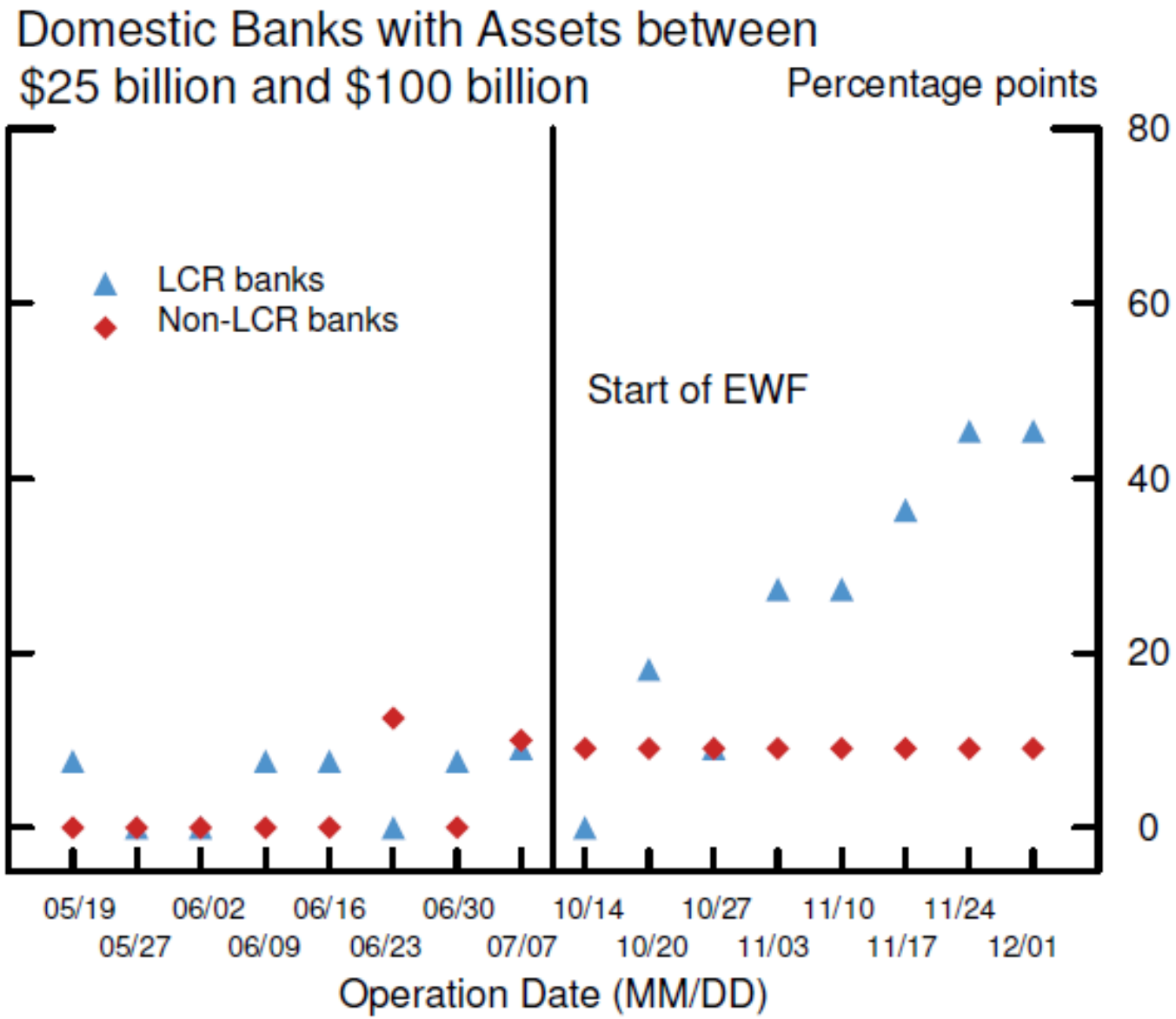
Motivation of Testing Strategy, Participation Rate



Motivation of Testing Strategy, Participation Rate



Motivation of Testing Strategy, Participation Rate



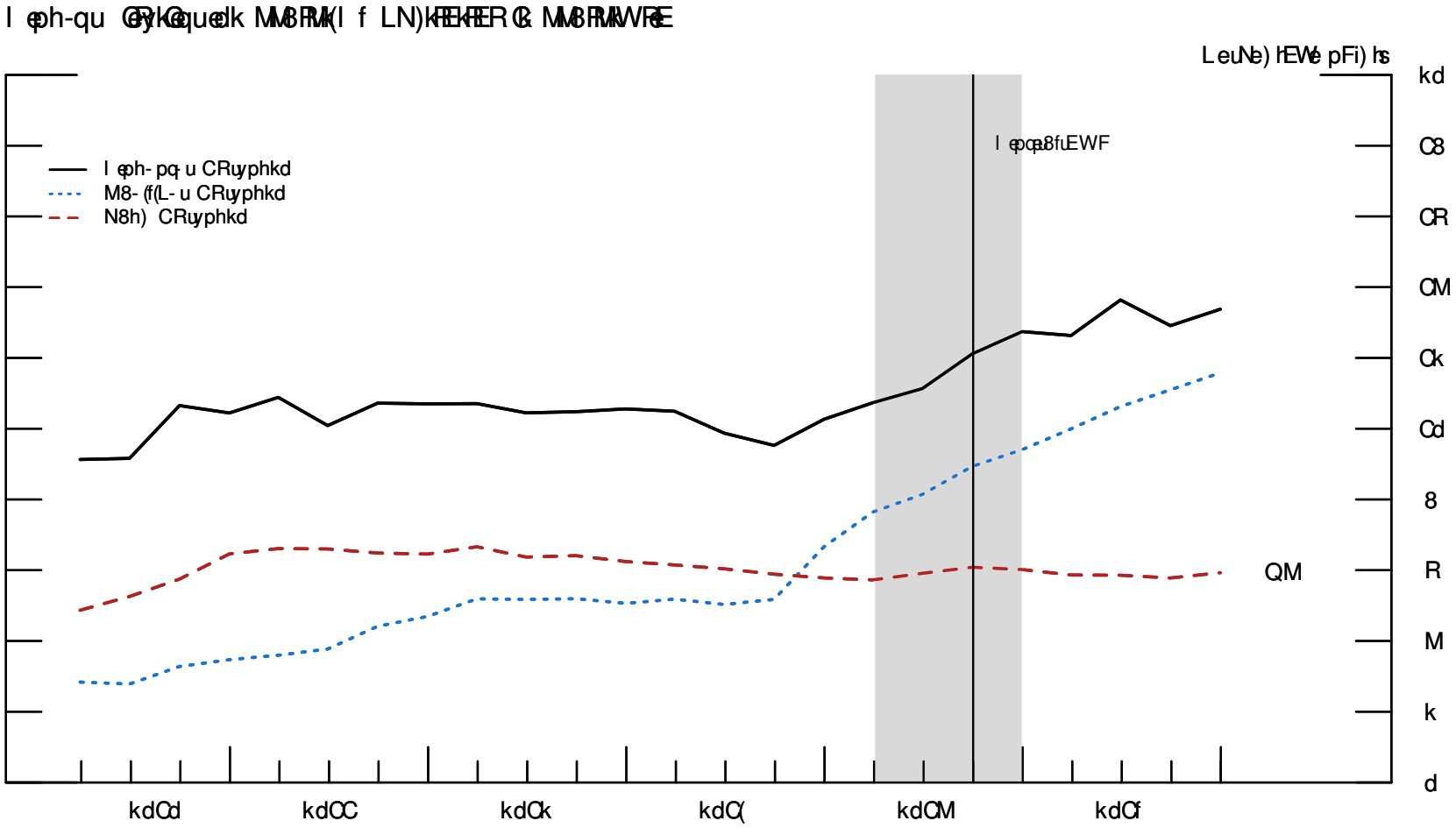
Liquidity Coverage Ratio (LCR)

- Two versions of the LCR: the standard and the modified.
- The standard LCR applies to
  1. All U.S. bank holding companies (BHCs) with $250 billion or more in total consolidated assets, or
  2. Banking organizations with $10 billion or more in on-balance-sheet foreign exposures
     - And depository institutions with assets of $10 billion or more under (1) or (2).
- Institutions subject to the standard version must have an LCR of at least 80, 90, and 100 percent by January 2015, 2016, and 2017.

Liquidity Coverage Ratio (LCR)

- The modified LCR applies to BHCs that do not meet the standard LCR thresholds but have $50 billion or more in total assets.
- Institutions subject to the modified version must have an LCR of at least 90 and 100 percent by January 2016 and 2017.
- We assume that the standard and the modified LCR affect banks equally.

HQLA Holdings by LCR Bank Groups



Term Deposit Facility (TDF)

- The TDF is a tool to control market interest rates.
- As part of the tests of the TDF, the Federal Reserve has changed many characteristics of the term deposits offered.
- In particular, while past operations did not allow banks to withdraw funds prior to maturity, all operations since October 2014 include an EWF, subject to a pecuniary penalty.

TDF Operation Characteristics

Table 1: TDF Operation Details

EWF	Operation date	Rate (basis points)	Maximum tender amount ($ billions)
No	May 19	26	3
No	May 27	26	5
No	June 2	26	7
No	June 9	26	10
No	June 16	27	10
No	June 23	28	10
No	June 30	29	10
No	July 7	30	10
Yes	October 14	26	5
Yes	October 20	26	10
Yes	October 27	26	15
Yes	November 3	26	20
Yes	November 10	27	20
Yes	November 17	28	20
Yes	November 24	29	20
Yes	December 1	30	20

Note: This tables shows summary statistics of all 16 TDF operations conducted from May to December 2014. All operations offered seven-day term deposits with fixed interest rates, full-allotment tenders, and a minimum tender amount of $10,000.

Data

- Panel of bank-operation pairs.
- Bank data (3,687 banks):
  - Dependent variables: Dummy for submitting a tender and
    Dollar amount of tender
  - Other bank characteristics, including assets, HQLA, and excess reserves
- TDF operations data (16 operations):
  - EWF dummy

Empirical Strategy: TDF Participation

- We estimate the following equation:

$$\begin{aligned} Y_{ij} &= \alpha LCRBank_{ij} + \beta LCRBank_{ij} \times t + \gamma LCRBank_{ij} \times t \times EWF_j \\ &\quad + \nu_i + \varphi_j + \varepsilon_{ij}, \end{aligned} \tag{1}$$

- where
  - Y_{ij} is a dummy for bank i offering a tender in operation j.
  - $LCRBank_i$ and EWF_j are dummies for the LCR and the EWF.
  - t is a time trend equal to one when the EWF starts.
  - ν_i is a bank random effect, φ_j an operation fixed effect, and ε_{ij} an idiosyncratic error.

Results: TDF Participation

Table 4: TDF Participation of Domestic Banks

	(1) All banks	(2) Banks with assets between $5 billion & $500 billion	(3) Banks with assets between $25 billion & $100 billion
LCRBank	0.186**	0.174*	0.123
	(0.071)	(0.076)	(0.082)
LCRBank × t	0.008	-0.001	-0.021
	(0.006)	(0.007)	(0.019)
LCRBank × t × EWF	0.023*	0.024*	0.071**
	(0.010)	(0.012)	(0.027)
Observations	58,992	1,994	344
Banks	3,687	126	24
R-squared	0.13	0.12	0.15

Note: This table shows estimates of equation (1). The dependent variable is a dummy variable equal to 1 if bank i submitted a tender in operation j and equal to 0 otherwise. $LCRBank_{ij}$ is a dummy variable equal to one if the bank's holding company i at the time of operation j was subject to either the standard or modified LCR requirement, and zero otherwise. EWF_j is the indicator of whether operation j has an EWF, and t is an operation trend normalized to one in the first operation with an EWF. All equations include operation fixed effects. Standard errors are clustered at the bank level and are shown in parentheses. * and ** denote significant at the 5 and 1 percent levels, respectively.

Empirical Strategy: Tender Amounts (Tobit Estimation)

- We estimate the following equation:

$$\begin{aligned} B_{ij} &= C_j, \ if \ C_j < Y_{ij} \\ &= Y_{ij}, \ if \ R_j \leq Y_{ij} \leq C_j \\ &= 0, \ if \ Y_{ij} < R_j, \end{aligned} \tag{2}$$

- where
  - B_{ij} is the tender amount submitted by bank i in operation j.
  - Y_{ij} is still determined by equation (1) but is now the latent value of bank i's tender amount in operation j.

Results: Tender Amounts

Table 5: TDF Tender Amounts of Domestic Banks

	(1) Banks with assets above $1 billion	(2) Banks with assets between $5 billion & $500 billion	(3) Banks with assets between $25 billion & $100 billion
LCRBank	27.630**	28.490**	50.033*
	(3.801)	(5.422)	(20.512)
LCRBank × t	0.012	-0.870*	-5.782*
	(0.356)	(0.444)	(2.596)
LCRBank × t × EWF	0.805	1.126	8.205**
	(0.549)	(0.675)	(3.138)
Observations	7,690	1,994	344
Banks	492	126	24
Log-likelihood	-1,162	-764	-164

Note: This table shows estimates of the model composed of equations (1) and (2). The dependent variable is the natural logarithm of bank ij's tender amount measured in thousands of U.S. dollars. $LCRBank$ is a dummy variable equal to one if the bank's holding company is subject to standard or modified LCR. EWF_j is the indicator of whether operation j has an EWF, and t is an operation trend normalized to one in the first operation with an EWF. All equations include operation fixed effects. Standard errors are clustered at the bank level and are shown in parentheses. * and ** denote significant at the 5 and 1 percent levels, respectively.

Robustness: Foreign Banks

- We now present additional results that rely on foreign banks which can be as large but are not subject to the U.S. LCR requirement.
- More specificaly, we estimate the following equation:

$$\begin{aligned} Y_{ij} &= \alpha DOM_i + \beta DOM_i \times t + \gamma DOM_i \times t \times EWF_j \\ &\quad + \nu_i + \varphi_j + \varepsilon_{ij}, \end{aligned} \tag{3}$$

- where all variables are defined as before except for DOM_i.
  $DOM_i = 1$ for domestic banks
  $DOM_i = 0$ for U.S. branches and agencies of foreign banks

Results: Foreign Banks

Table 6: TDF Participation of Large Domestic and Large Foreign Banks

	Large Banks			Small Banks		
	(1)	(2)	(3)	(4)	(5)	(6)
	Banks with assets above $50 billion	Banks with assets between $50 b & $500 b	Banks with assets between $50 b & $100 b	Banks with assets below $50 billion	Banks with assets between $5 b & $50 b	Banks with assets between $25 b & $50 b
DOM	-0.045	-0.054	-0.138	-0.015	-0.044	-0.192
	(0.129)	(0.130)	(0.146)	(0.013)	(0.043)	(0.166)
DOM × t	-0.023	-0.028*	-0.038*	-0.006*	-0.008	-0.032
	(0.014)	(0.014)	(0.019)	(0.002)	(0.006)	(0.032)
DOM × t × EWF	0.031	0.034	0.083**	0.002	0.005	0.041
	(0.019)	(0.020)	(0.030)	(0.003)	(0.009)	(0.039)
Observations	799	735	373	61,217	2,391	314
Banks	51	47	26	3,827	155	23
R-squared	0.08	0.09	0.17	0.02	0.04	0.24

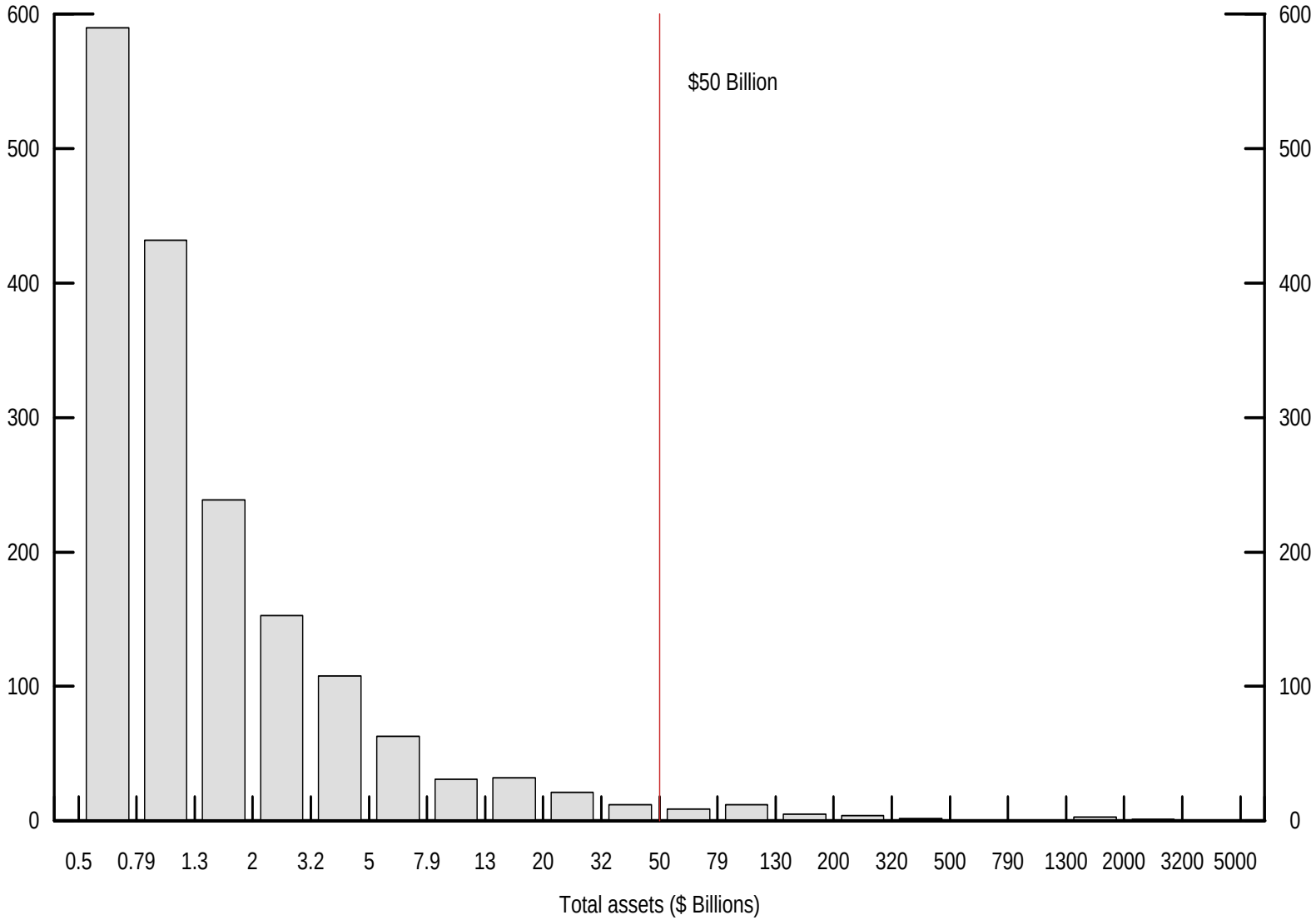
Note: This table shows estimates of equation (3). The dependent variable is a dummy variable equal to 1 if bank i submitted a tender in operation j and equal to 0 otherwise. DOM_i is a dummy variable equal to one for domestic banks and equal to zero for foreign banks. EWF_j is the indicator of whether operation j has an EWF, and t is an operation trend normalized to one in the first operation with an EWF. All equations include operation fixed effects. Standard errors are clustered at the bank level and are shown in parentheses. * and ** denote significant at the 5 and 1 percent levels, respectively.

Concluding Remarks

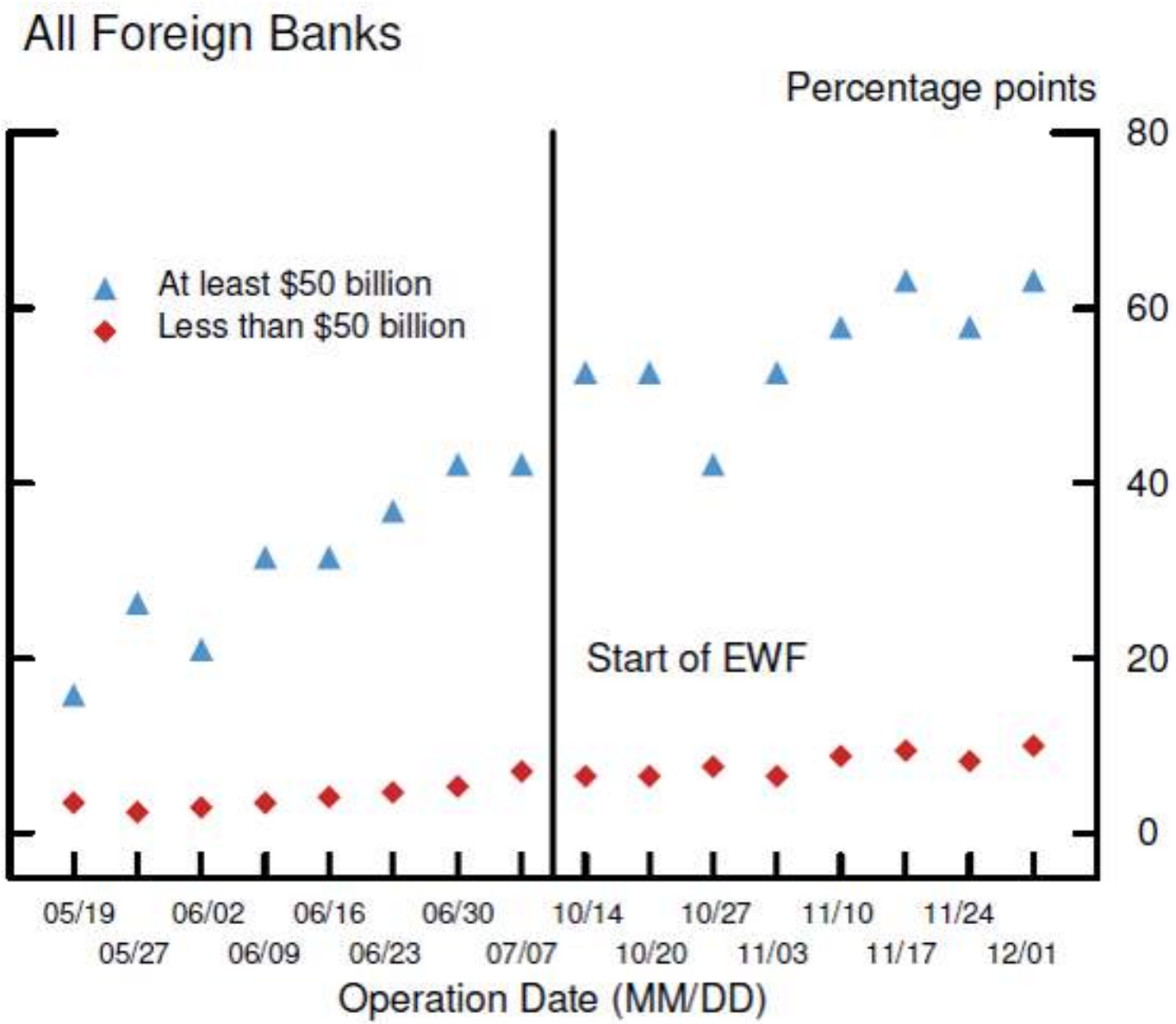
- Liquidity regulation affects bank demand in the TDF.
- Open question: Does liquidity regulation affect transmission of monetary policy through banks?
  - If liquidity regulation affects demand for term deposits, it could also affect demand for excess reserves.
  - Some evidence that amount of excess reserves affects transmission of monetary policy through banks.
  - More broadly, evidence that bank characteristics affects the impact of monetary policy on bank credit supply.

APPENDIX

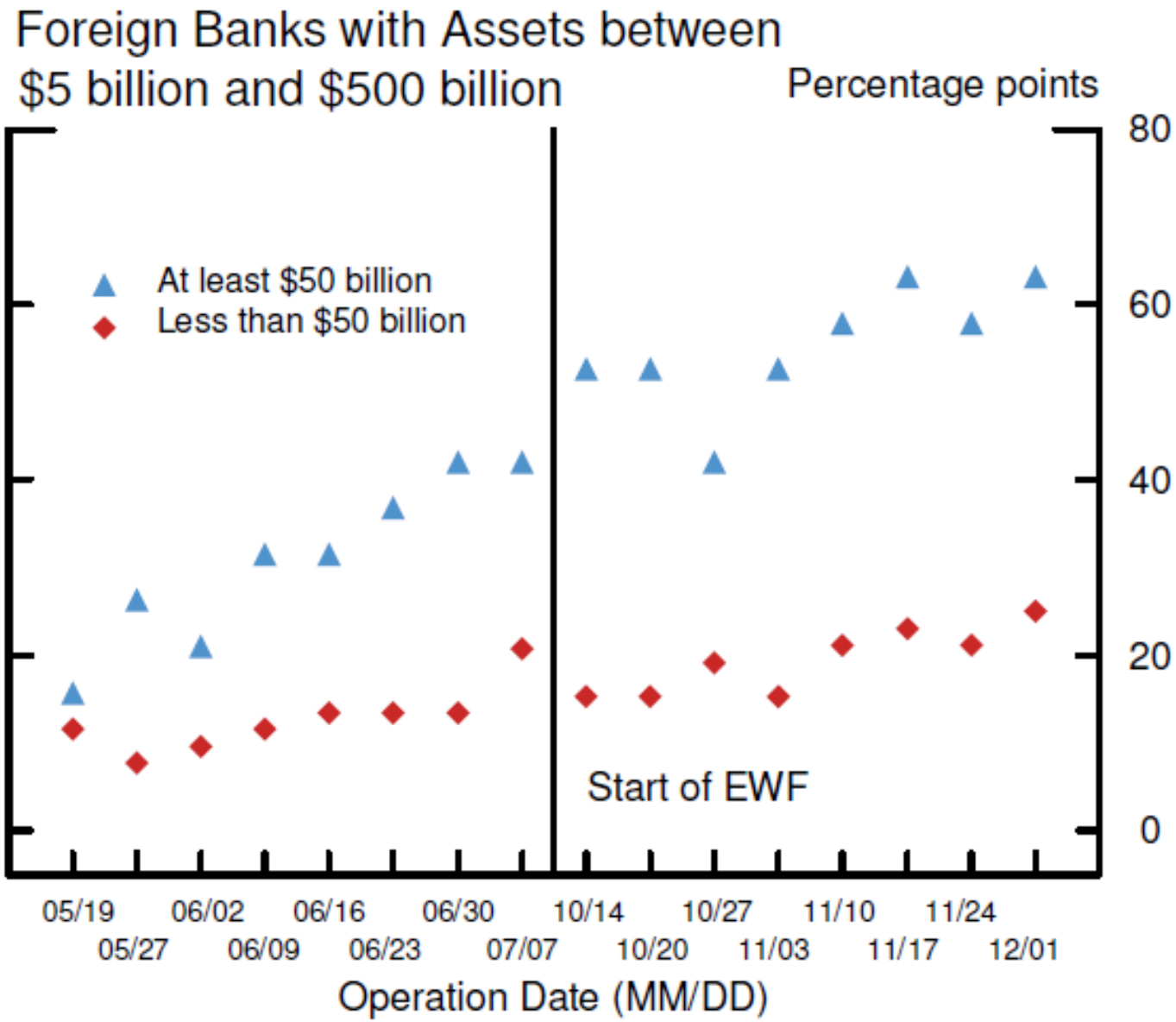
Appendix: Bank Size Distribution



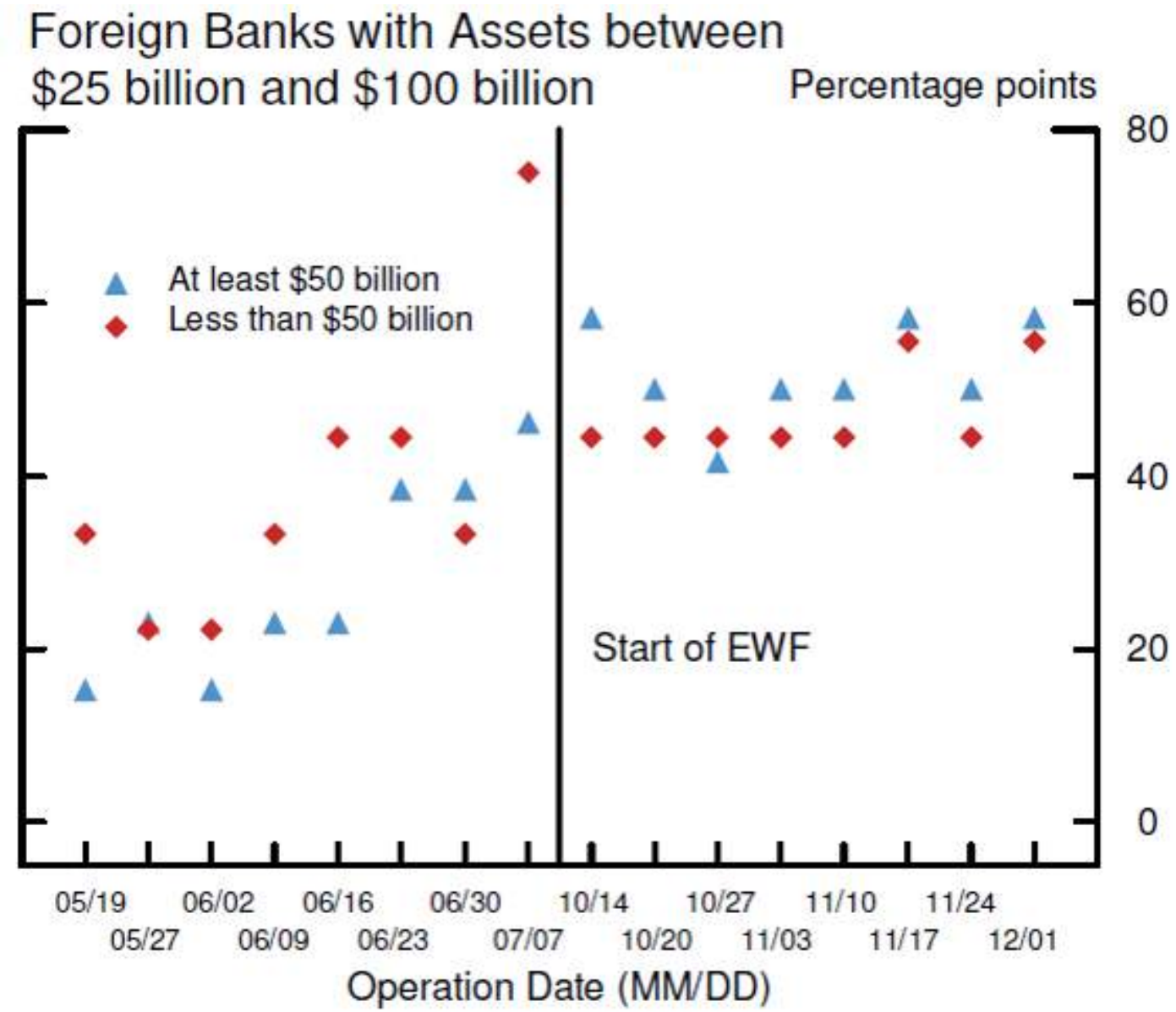
Appendix: Foreign Counterfactual



Appendix: Foreign Counterfactual



Appendix: Foreign Counterfactual



Robustness: Bank Characteristics

Table 7: Robustness Tests of TDF Participation

	(1) Banks with assets between \$25 b & \$100 b & min. excess reserves	(2) Banks with assets between \$25 b & \$100 b, min. excl. res. & TDF access	(3) Banks with assets between \$25 b & \$100 b	(4) Banks with assets between \$25 b & \$100 b
LCRBank	0.136	0.247	0.143	0.105
	(0.094)	(0.184)	(0.084)	(0.090)
LCRBank × t	-0.024	-0.052	-0.019	-0.021
	(0.021)	(0.043)	(0.018)	(0.020)
LCRBank × t × EWF	0.073**	0.108**	0.060**	0.070**
	(0.028)	(0.043)	(0.024)	(0.026)
Bank characteristics?	No	No	No	Yes
All banks under BHC?	No	No	Yes	No
Observations	328	215	392	344
Banks	23	15	28	24
R-squared	0.14	0.18	0.14	0.27

The Cost of Immediacy for Corporate Bonds

Jens Dick-Nielsen Marco Rossi

The 3rd MIT Golub Center for Finance and Policy conference
September 28-29, 2016

FRIC • CENTER FOR FINANCIAL FRICTIONS

Corporate bond market: background

- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.

Corporate bond market: background

- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.

Corporate bond market: background

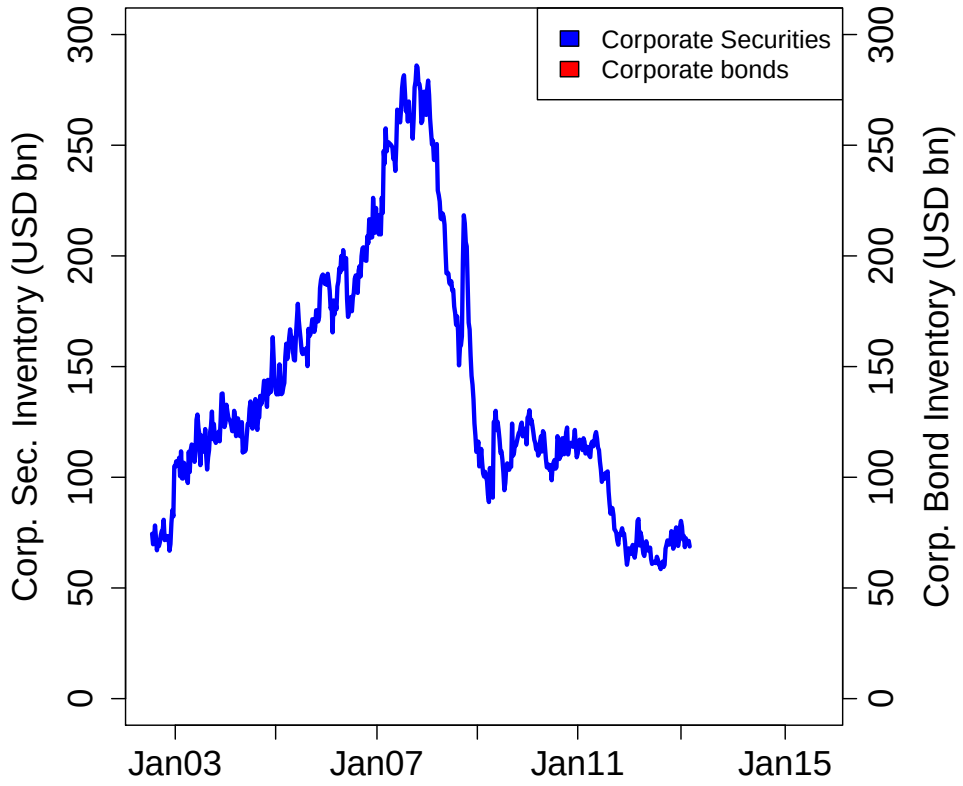
- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.

Corporate bond market: background

- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.

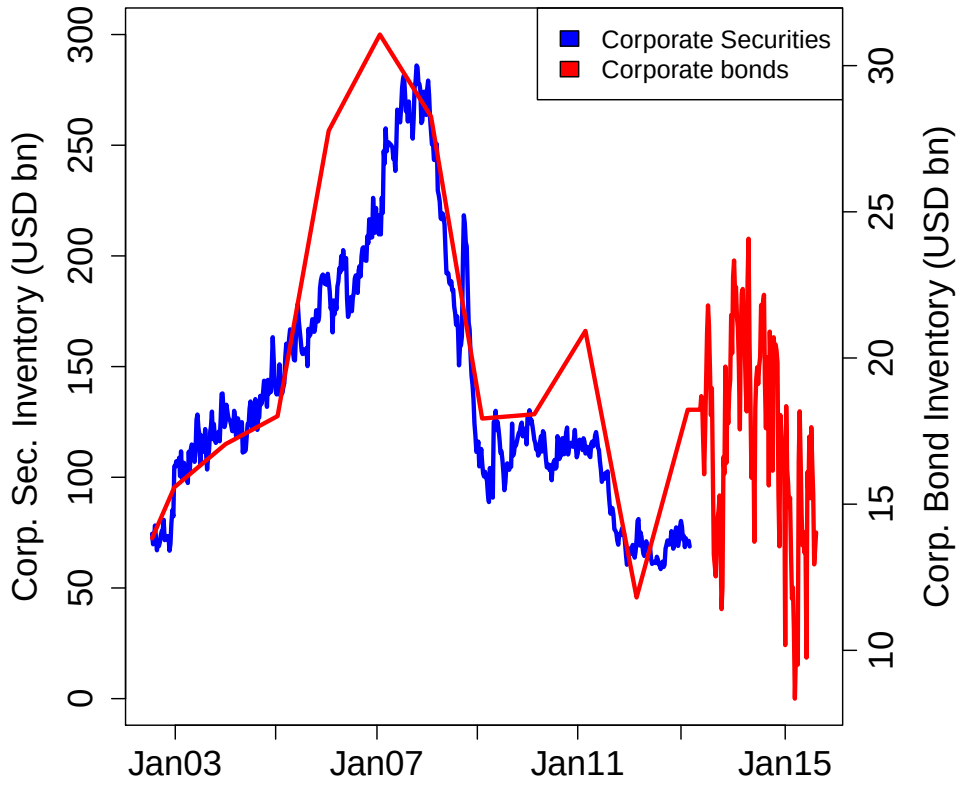
Corporate bond market: background

- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.



Corporate bond market: background

- OTC, dealer-driven market.
- Dealers use inventory to provide liquidity/immediacy.



Impact of regulation: The industry's viewpoint

"Bank broker-dealers are responding to the impacts of regulation by changing their models. As a result of more discerning capital allocation within the banks, there is a shift to running smaller inventory, but increasing turnover."

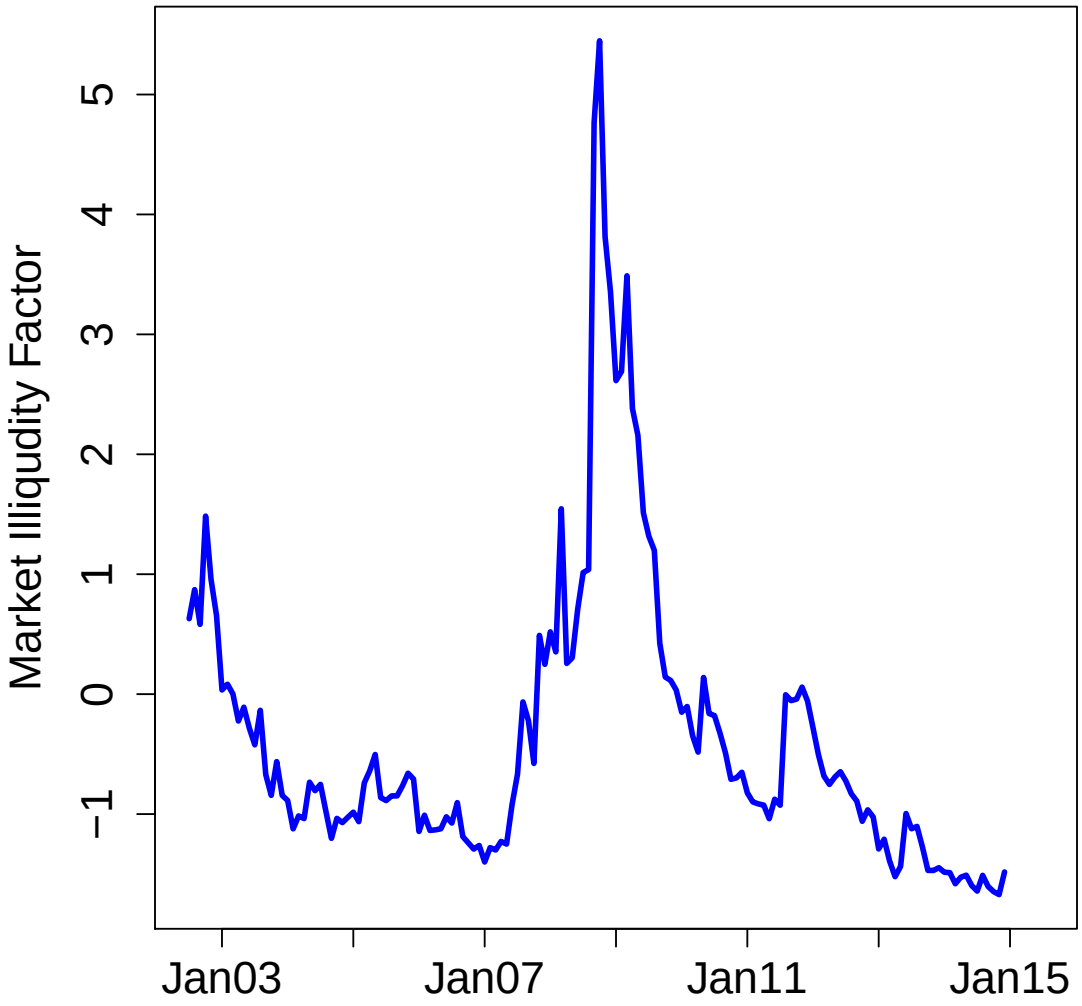
- ICMA, (Hill, 2014). Based on a broker-dealer survey.

Impact of regulation: The regulators' response

"Based on the totality of information collected and analyzed, IOSCO did not find substantial evidence showing that liquidity in the secondary corporate bond markets has deteriorated markedly from historic norms for non-crisis periods."

- IOSCO (Aug, 2016).

Regulators' argument



From Dick-Nielsen, Feldhütter, and Lando (2012).

Conjectures on regulatory impact e.g. Volcker rule

- will reduce systemic risk (Richardson, 2012)
- will discourage genuine market making (Duffie, 2012)
- existing empirical evidence dismisses impact of regulation as inconsequential for liquidity (Trebbi and Xiao, 2015; Adrian, Fleming, Shachar, and Vogt, 2015)

What do you prefer?

Going from LA to NY:

What do you prefer?

Going from LA to NY:

What do you prefer?

Going from LA to NY:

What do you prefer?

Going from LA to NY:

$600

5 hours

$175

3 days

Motivation and Contribution

Agents' response to policy change (Lucas, 1976)

- econometric evaluation of policy change can be misguided
- measures of liquidity (bid-ask) are outcome of optimization problem

Motivation and Contribution

Agents' response to policy change (Lucas, 1976)

- econometric evaluation of policy change can be misguided
- measures of liquidity (bid-ask) are outcome of optimization problem

Our empirical design circumvents the Lucas Critique

- Natural experiment: index exclusions
  - recurring and information-free event
  - agents have urgency to trade (inelastic demand function)
- Decrease in inventories comes with an increased cost of immediacy
  - more than doubled for investment grade bond
  - more than tripled for speculative grade bond

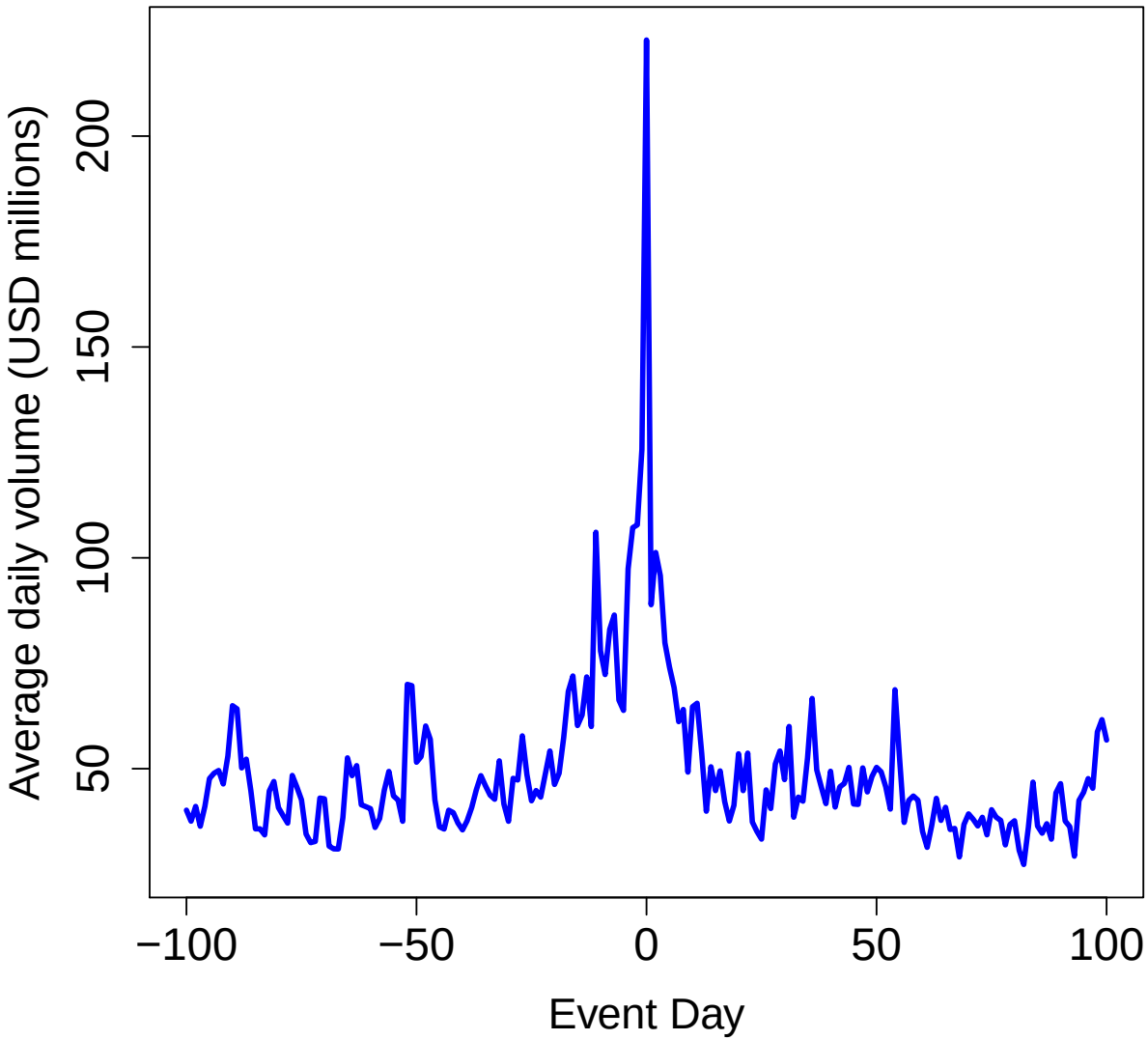
Natural experiment - Index Tracking

- Index trackers seek to minimize their tracking error and transact close to the rebalancing date.
- Bond index trackers sample the index.
  - 80% invested in the index and up to 20% outside the index.
- The Barclay Capital corporate bond index (Lehman index):
  - All investment grade bonds above a certain size.
  - Rebalanced at the last day of each month.
  - The mechanical index rules make exclusions and inclusions information-free events.

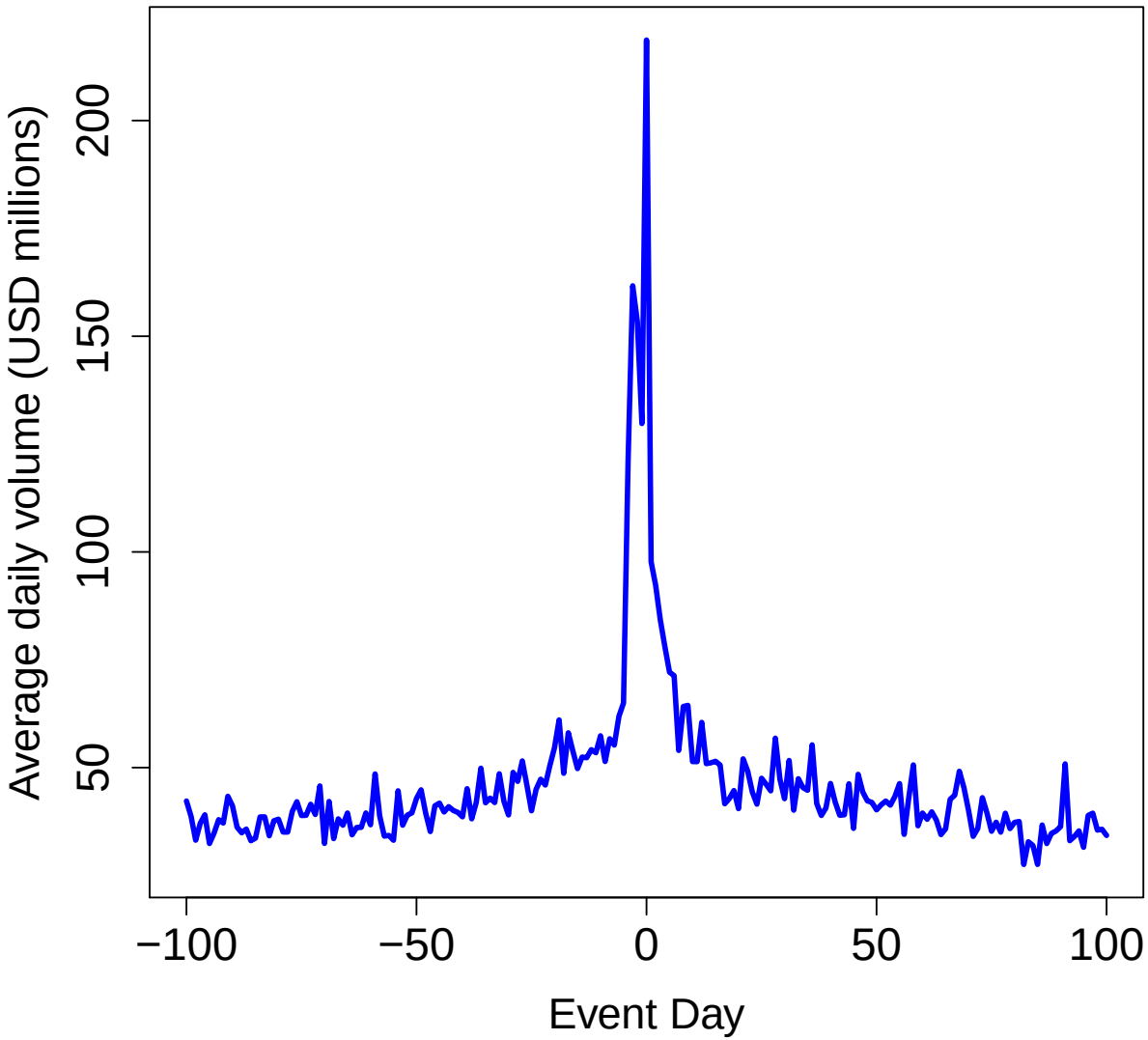
Index exclusions

Reason	N	Average amt. ($1,000)	Average Duration	Average Coupon
Maturity<1	1,998	547,124	0.92	5.9
Called	257	319,406	0.78	7.4
Downgrade	912	601,028	5.0	6.9
Other	1,773	252,425	5.8	6.7

Downgrade exclusion - Volume



Maturity exclusion - Volume



Implications

- urgency to trade exactly at the exclusion
- demand for immediacy is inelastic
- index trackers cannot pursue alternatives without affecting tracking error
- set up circumvents Lucas critique

Implications

- urgency to trade exactly at the exclusion
- demand for immediacy is inelastic
- index trackers cannot pursue alternatives without affecting tracking error
- set up circumvents Lucas critique

Implications

- urgency to trade exactly at the exclusion
- demand for immediacy is inelastic
- index trackers cannot pursue alternatives without affecting tracking error
- set up circumvents Lucas critique

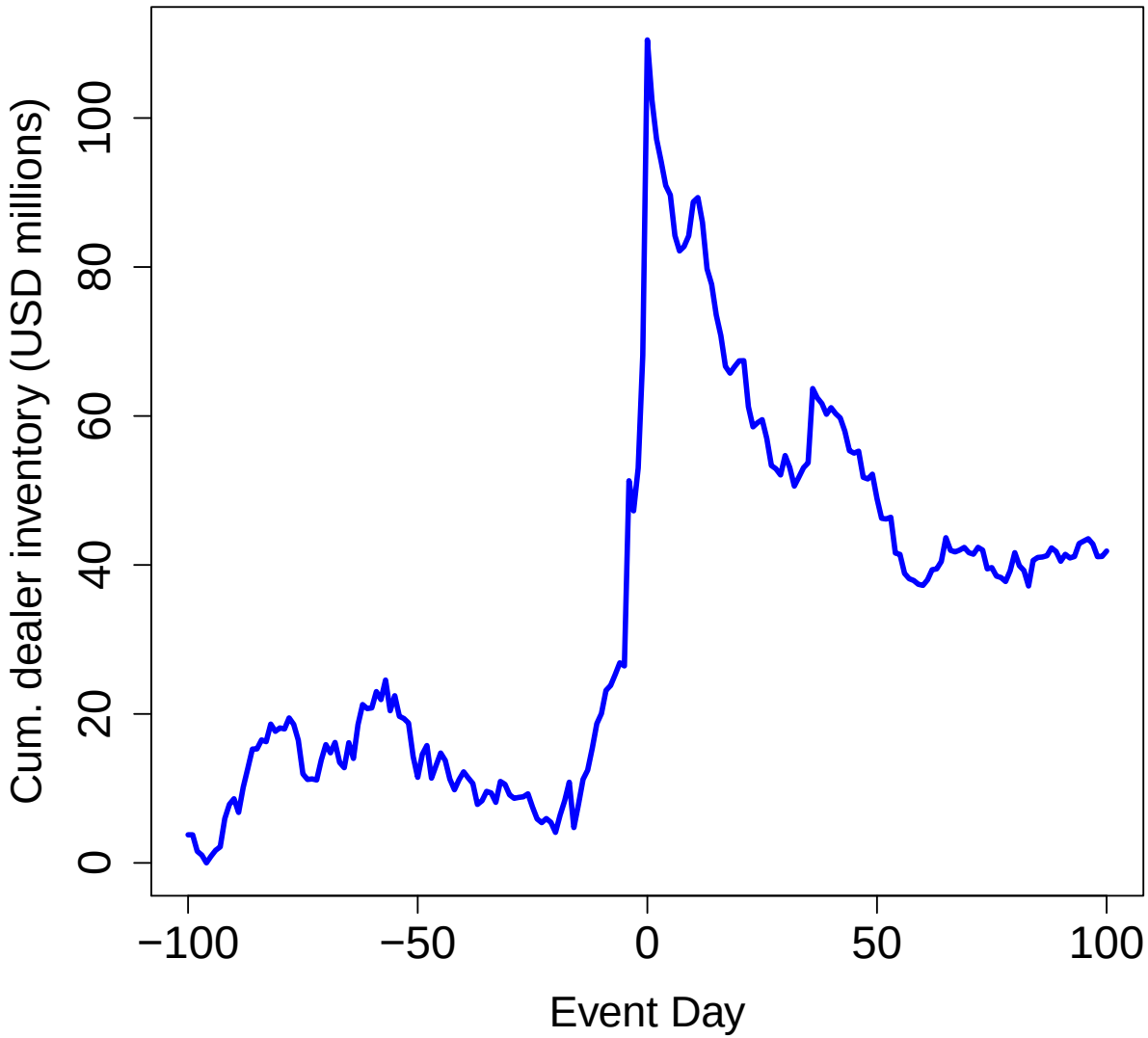
Implications

- urgency to trade exactly at the exclusion
- demand for immediacy is inelastic
- index trackers cannot pursue alternatives without affecting tracking error
- set up circumvents Lucas critique

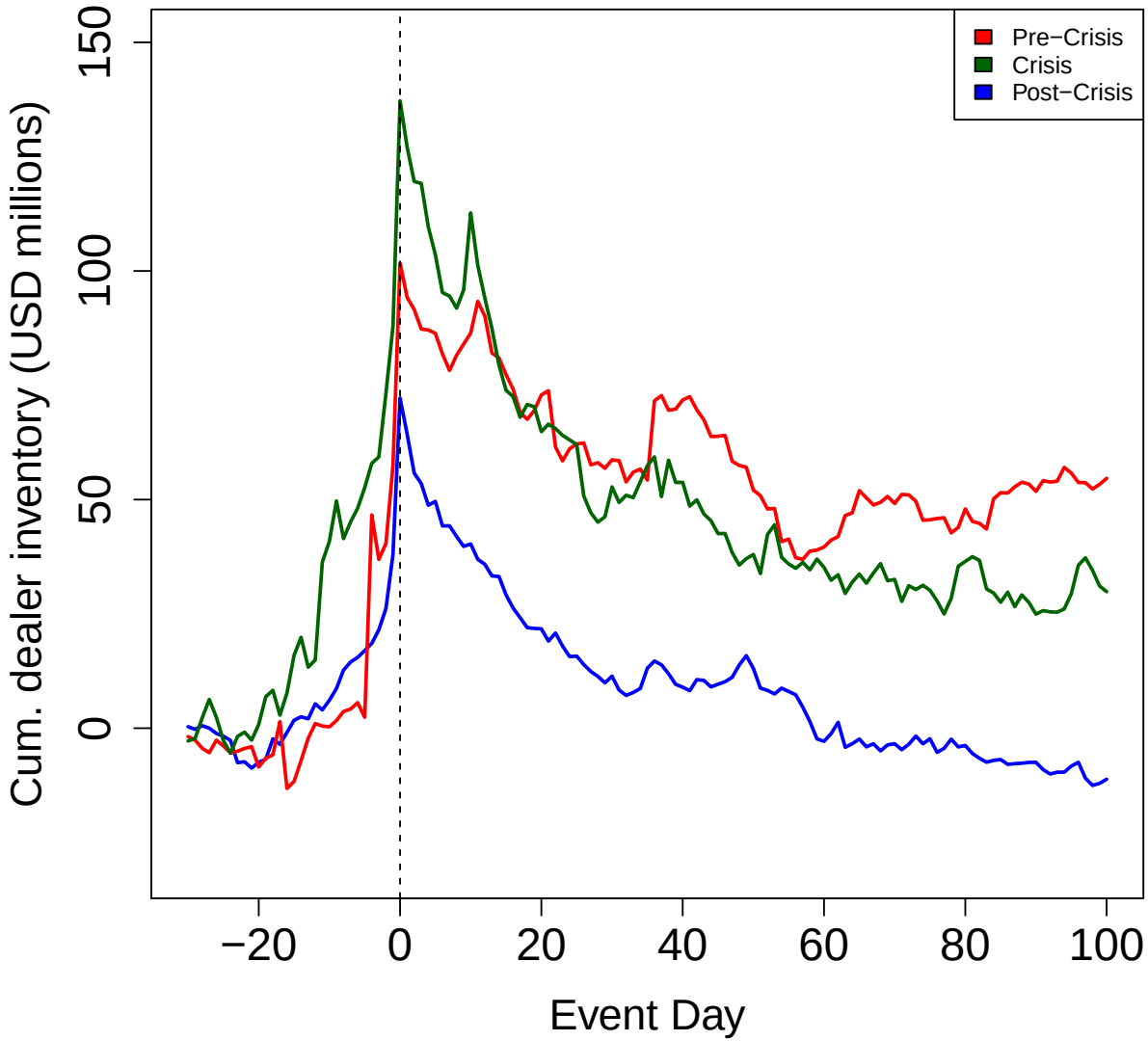
Implications

- urgency to trade exactly at the exclusion
- demand for immediacy is inelastic
- index trackers cannot pursue alternatives without affecting tracking error
- set up circumvents Lucas critique

Downgrade exclusion - Inventory



Downgrade exclusion - Inventory



Crisis period: June 2007 - Aug 2009.

Downgrade - Summary

- Index trackers do sell out very close to the rebalancing date.
- Dealers provide immediacy and trade against the index trackers.
- Before the crisis dealers kept the bonds on inventory and after the crisis they unload over a couple of weeks.

Downgrade - Summary

- Index trackers do sell out very close to the rebalancing date.
- Dealers provide immediacy and trade against the index trackers.
- Before the crisis dealers kept the bonds on inventory and after the crisis they unload over a couple of weeks.

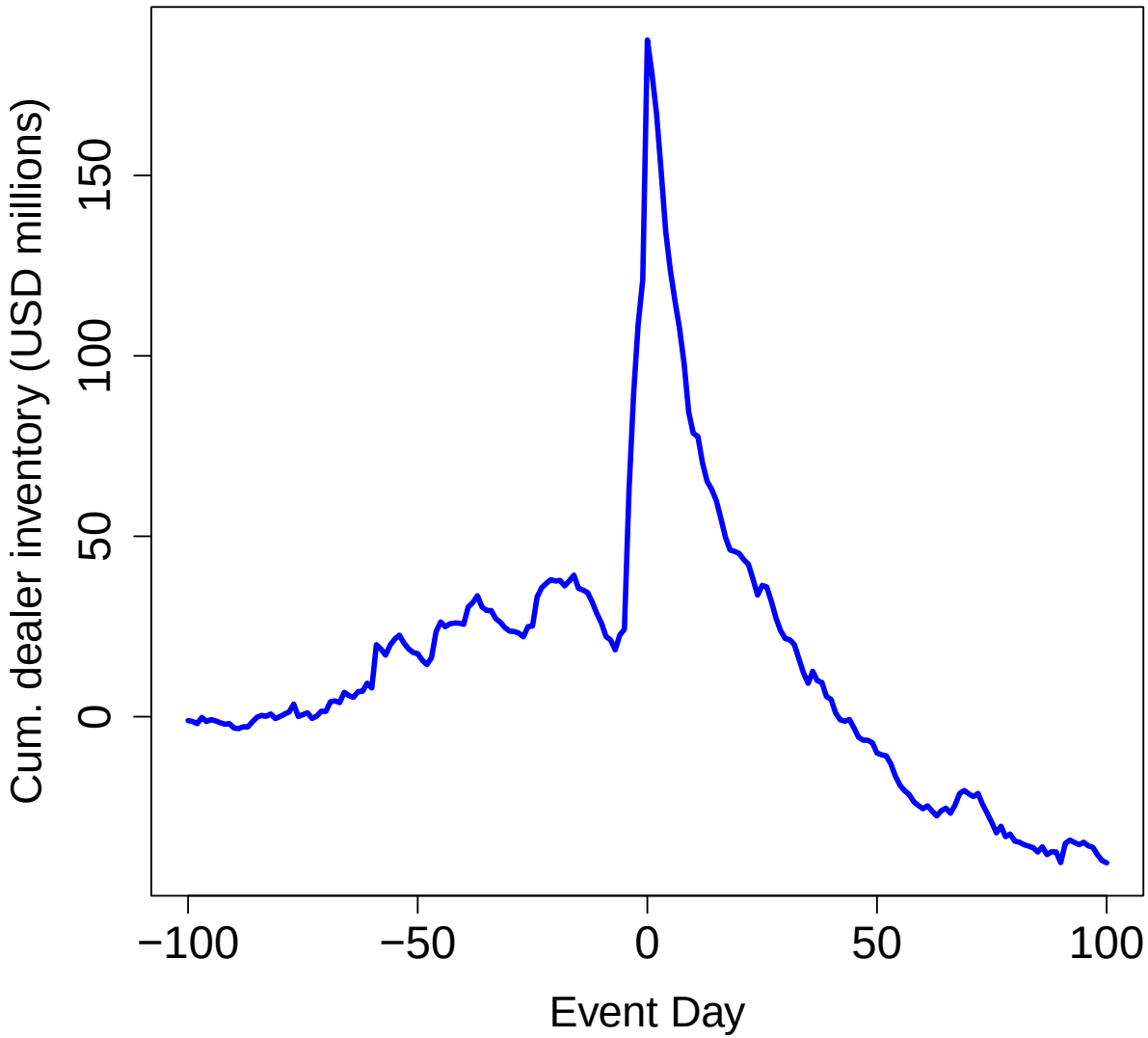
Downgrade - Summary

- Index trackers do sell out very close to the rebalancing date.
- Dealers provide immediacy and trade against the index trackers.
- Before the crisis dealers kept the bonds on inventory and after the crisis they unload over a couple of weeks.

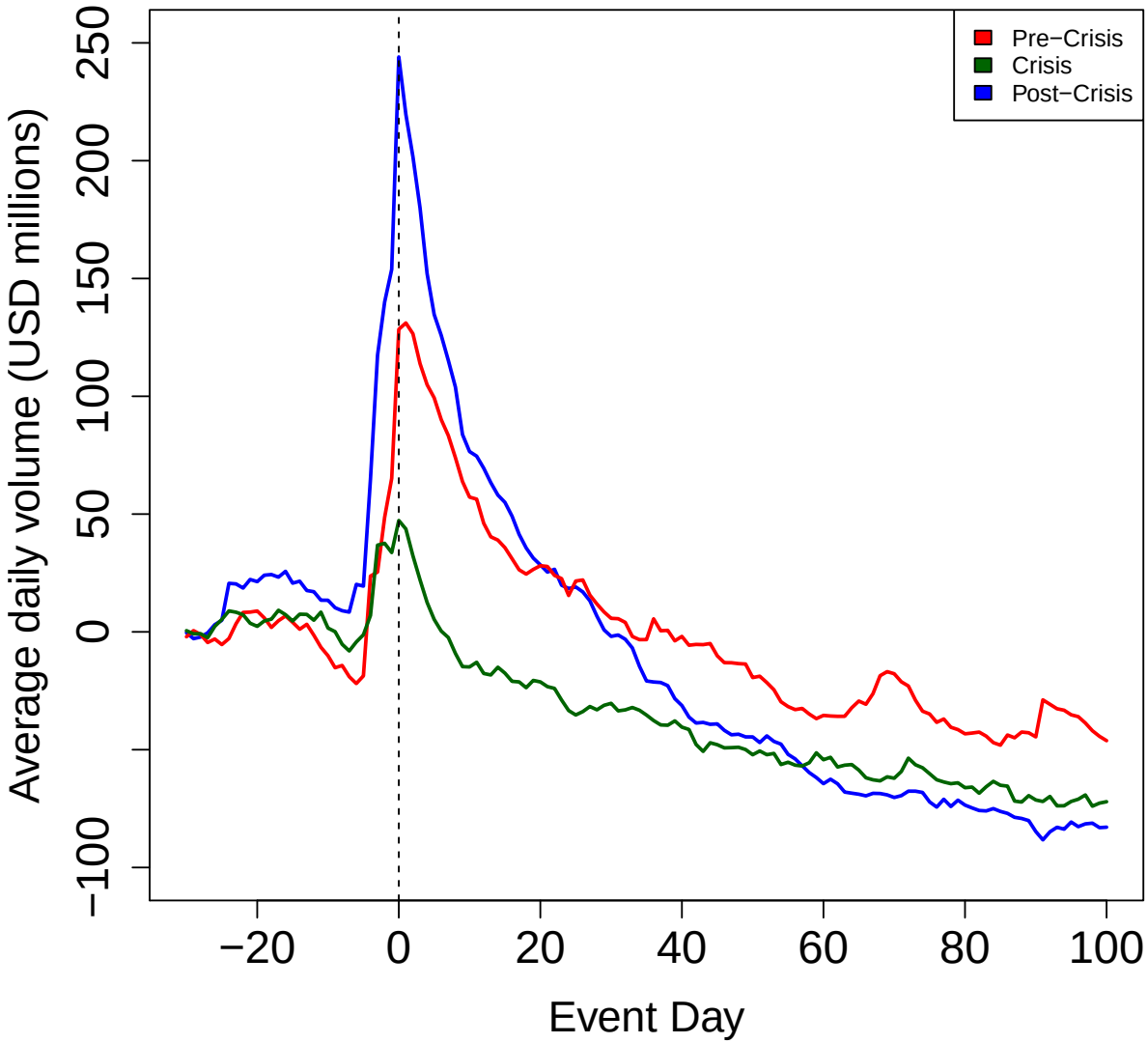
Downgrade - Summary

- Index trackers do sell out very close to the rebalancing date.
- Dealers provide immediacy and trade against the index trackers.
- Before the crisis dealers kept the bonds on inventory and after the crisis they unload over a couple of weeks.

Maturity exclusion - Inventory



Maturity exclusion - Inventory



Maturity - Summary

- Index trackers do sell out very close to the rebalancing date.
- Dealers provide immediacy and trade against the index trackers.
- During the crisis dealers also unload own holdings after index exclusion. Maybe as a way to secure funding.
- Behavior is more or less the same before and after the crisis. BUT the costs are not!

Event returns: intertemporal bid-ask spread

Event returns: intertemporal bid-ask spread

1. Enhanced TRACE directly from FINRA

Event returns: intertemporal bid-ask spread

1. Enhanced TRACE directly from FINRA
   - sample period: 2002 to 2013

Event returns: intertemporal bid-ask spread

1. Enhanced TRACE directly from FINRA
   - sample period: 2002 to 2013
   - contains dealer identifiers

Event returns: intertemporal bid-ask spread

1. Enhanced TRACE directly from FINRA
   - sample period: 2002 to 2013
   - contains dealer identifiers
2. In order to mimic the dealer returns, the pre-event price is a dealer-buy price and the post-event price is a dealer-sell price (intertemporal bid-ask spread)

Event returns: intertemporal bid-ask spread

1. Enhanced TRACE directly from FINRA
   - sample period: 2002 to 2013
   - contains dealer identifiers
2. In order to mimic the dealer returns, the pre-event price is a dealer-buy price and the post-event price is a dealer-sell price (intertemporal bid-ask spread)
3. Calculate abnormal returns as in Bessembinder, Kahle, Maxwell, and Xu (2009)

Event Returns - Maturity exclusion / pre-crisis

[0, t]	N	Intertemporal Bid-Ask	Abnormal Returns		
			EW	VW1	VW2
1	830		20.22	6.34	6.17
			(12.80)***	(9.23)***	(8.04)***
2	794		20.78	7.31	7.13
			(13.06)***	(10.65)***	(8.12)***
3	780		21.15	7.66	7.94
			(12.92)***	(10.05)***	(9.43)***
4	777		23.03	7.87	8.33
			(12.35)***	(7.92)***	(9.41)***
5	763		22.17	7.59	7.74
			(13.12)***	(8.74)***	(7.60)***
10	727		21.29	8.05	8.20
			(12.20)***	(6.22)***	(7.20)***
20	688		22.76	7.20	7.53
			(9.86)***	(8.40)***	(6.82)***
30	675		23.22	7.92	7.50
			(9.88)***	(7.13)***	(6.46)***

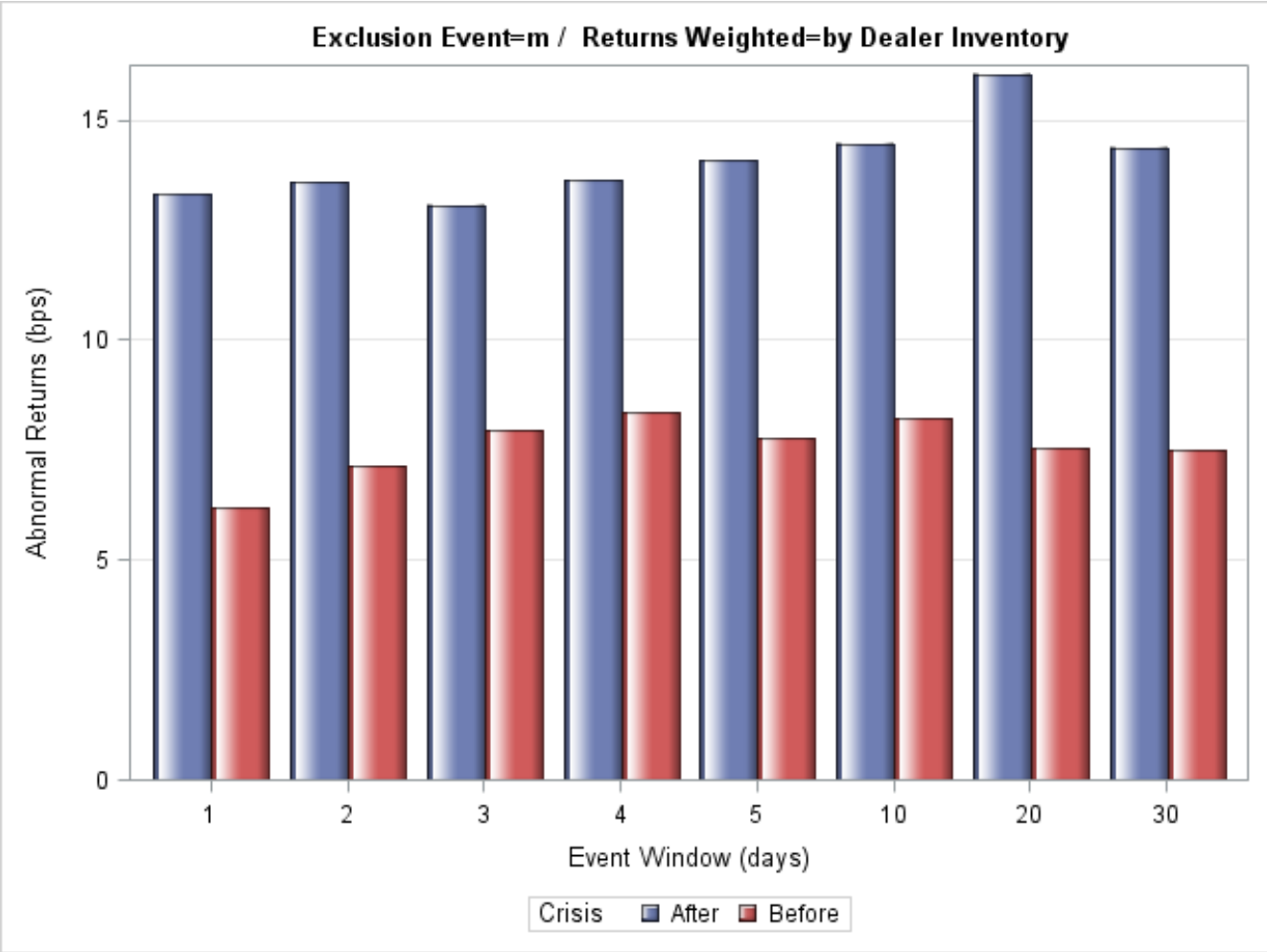
Event Returns - Maturity exclusion / crisis

$[0, t]$	N	Intertemporal Bid-Ask	Abnormal Returns		
			EW	VW1	VW2
1	269		46.33	50.43	43.02
			(10.26)***	(6.71)***	(6.50)***
2	254		46.57	50.86	42.12
			(8.12)***	(6.25)***	(5.13)***
3	236		49.80	56.52	52.18
			(7.16)***	(5.70)***	(5.00)***
4	235		52.96	56.89	48.79
			(8.38)***	(7.34)***	(6.35)***
5	230		53.18	56.27	47.12
			(6.23)***	(6.35)***	(6.12)***
10	211		63.28	68.71	54.53
			(7.36)***	(7.00)***	(5.09)***
20	211		76.35	72.47	54.52
			(5.58)***	(4.32)***	(3.11)***
30	206		96.55	102.75	80.71
			(4.66)***	(3.90)***	(3.52)***

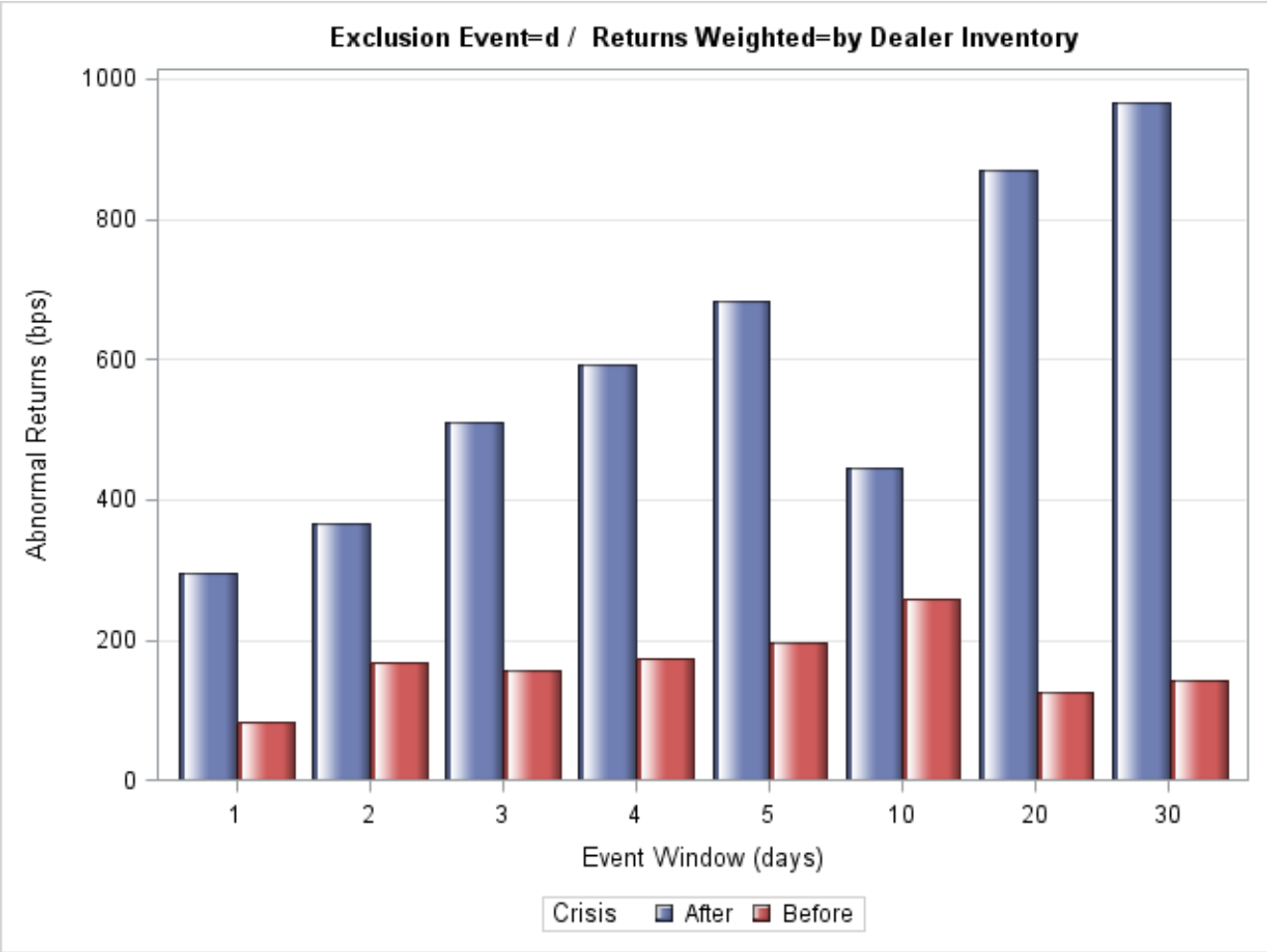
Event Returns - Maturity exclusion / post-crisis

		Intertemporal Bid-Ask	Abnormal Returns		
$[0, t]$	N		EW	VW1	VW2
1	1,085		26.27	13.53	13.30
			(12.76)***	(8.24)***	(8.54)***
2	1,054		27.16	13.79	13.59
			(13.70)***	(9.94)***	(10.12)***
3	1,041		26.47	13.25	13.06
			(12.83)***	(10.15)***	(10.15)***
4	995		29.46	13.99	13.62
			(12.22)***	(8.64)***	(8.73)***
5	990		30.06	14.35	14.08
			(12.29)***	(7.80)***	(7.84)***
10	954		30.19	14.87	14.46
			(13.38)***	(9.24)***	(9.23)***
20	861		34.06	15.93	16.02
			(10.49)***	(9.55)***	(9.23)***
30	814		34.20	15.09	14.37
			(10.39)***	(9.42)***	(8.73)***

Maturity event abnormal returns: summary



Downgrade event abnormal returns: summary



Regression analysis: set up

Demand and Supply of Immediacy

$$\begin{aligned} Q_t^D &= \alpha_0 + \alpha_1 P_t + e_t \\ Q_t^S &= \beta_0 + \beta_1 P_t + u_t \\ Q_t^D &= Q_t^S = Q_t \end{aligned}$$

Identification: $\alpha_1 = 0$

Regression setup:

- P_t: intertemporal bid-ask spread (dependent variable)
- Q_t: measure(s) of inventory buildup (independent variable)
- Q_t is interacted with sub-period dummies to capture changes in supply
- we control for bond characteristics and other macro variables

Cost of Immediacy before/during/after the crisis

Event Window: (0,t]	3	5	20	30
Q*Postcrisis	1.00	1.41	1.95	2.17
	(2.61)***	(2.90)***	(2.47)**	(2.03)**
Q*Crisis	2.39	5.39	6.12	5.58
	(2.19)**	(2.84)***	(2.54)**	(2.33)**
Q*Precrisis	0.19	0.17	-0.03	0.19
	(1.14)	(0.78)	(-0.09)	(0.45)
Log Issue Size	-22.75	-16.81	2.47	68.36
	(-1.39)	(-0.66)	(0.09)	(1.25)
Dealer Lev. Growth	-77.85	-96.80	-189.4	-220.1
	(-1.28)	(-0.82)	(-1.33)	(-0.87)
VIX	3.83	2.81	7.91	5.42
	(2.08)**	(1.19)	(2.38)**	(1.05)
TED Spread	1.93	2.38	1.83	3.11
	(3.35)***	(2.85)***	(1.67)*	(1.50)
Number of Observations	14993	14634	13401	12919
Adjusted R-Square	0.3407	0.3480	0.4126	0.3287

Lower Market Share

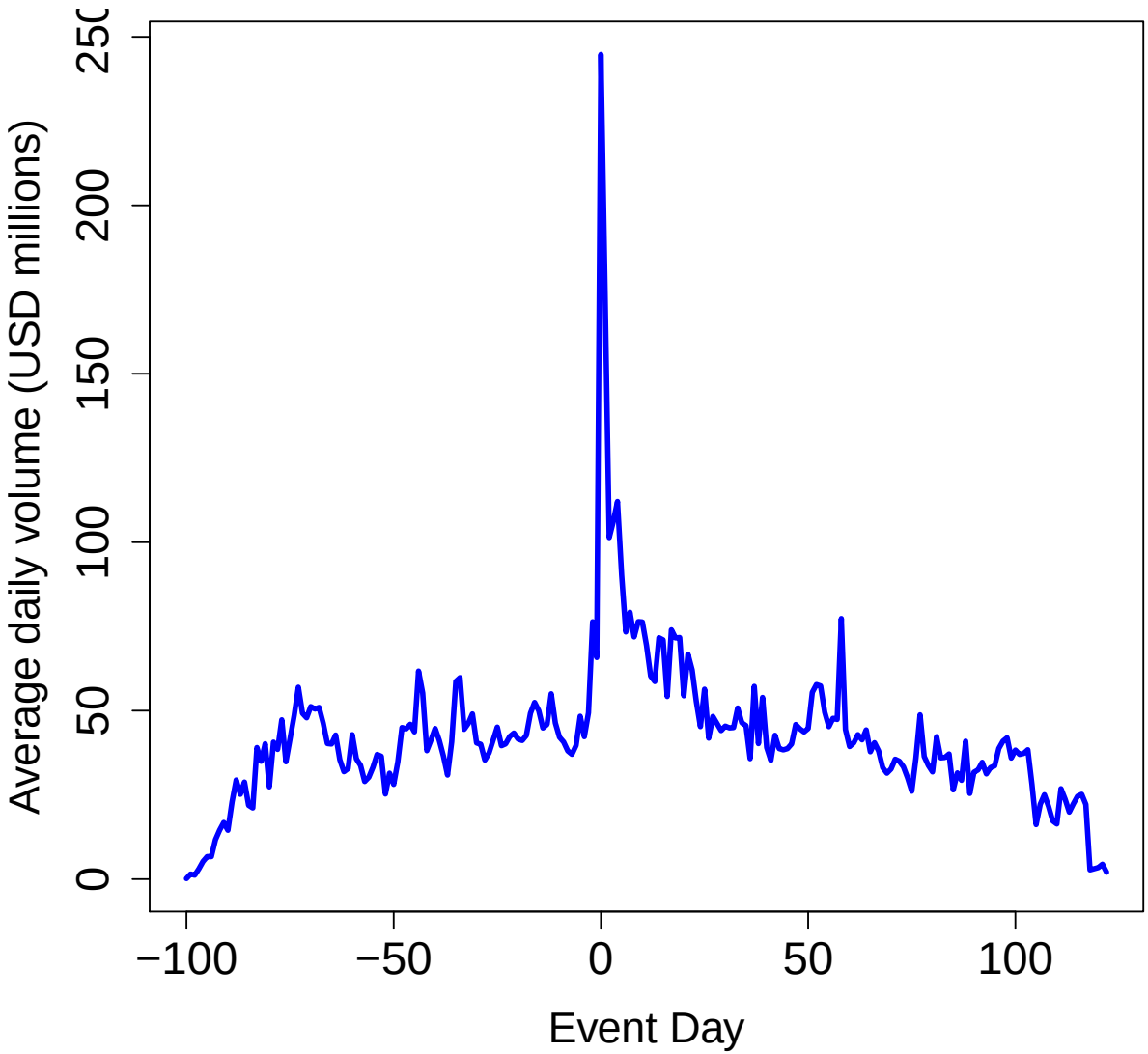
- Duffie (2012) predicts lower market share for traditional market makers.
- We find a decrease in market share for the top 4 most active dealers.

	Pre-Crisis	Crisis	Post-Crisis
Maturity exclusion	0.212	0.108	0.128
Downgrade exclusion	0.320	0.183	0.235

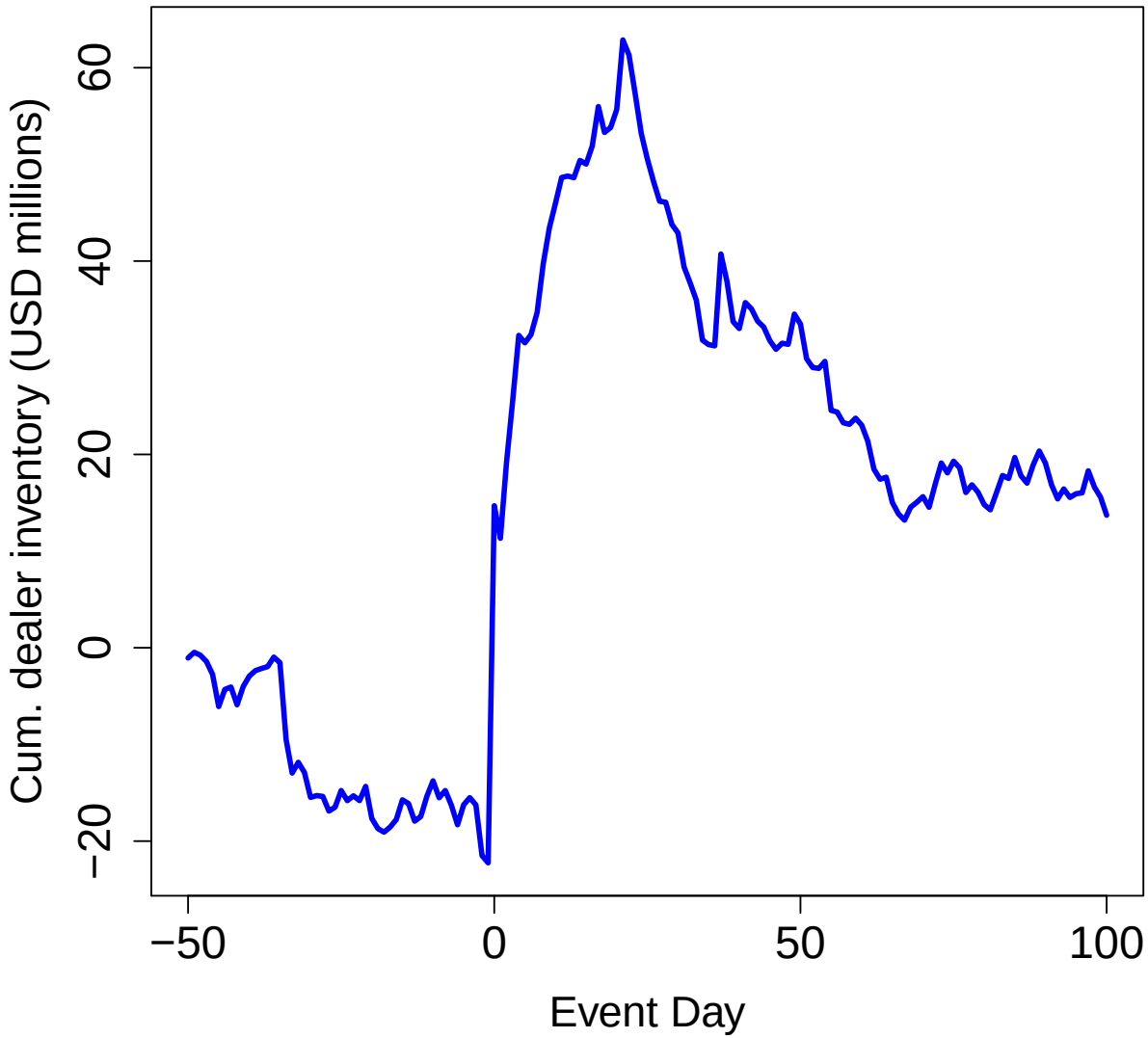
Conclusion

- Higher cost of immediacy.
- Consistent with expected side-effect of regulation (Duffie, 2012).
- Market makers take on less risk.
  (maybe Dodd-Frank is a success?)
- But fire-sales have potentially become more costly which will have a destabilizing effect.

Downgrade date - Volume



Downgrade date - Inventory



Downgrade Vs Downgrade Exclusion (t-4)

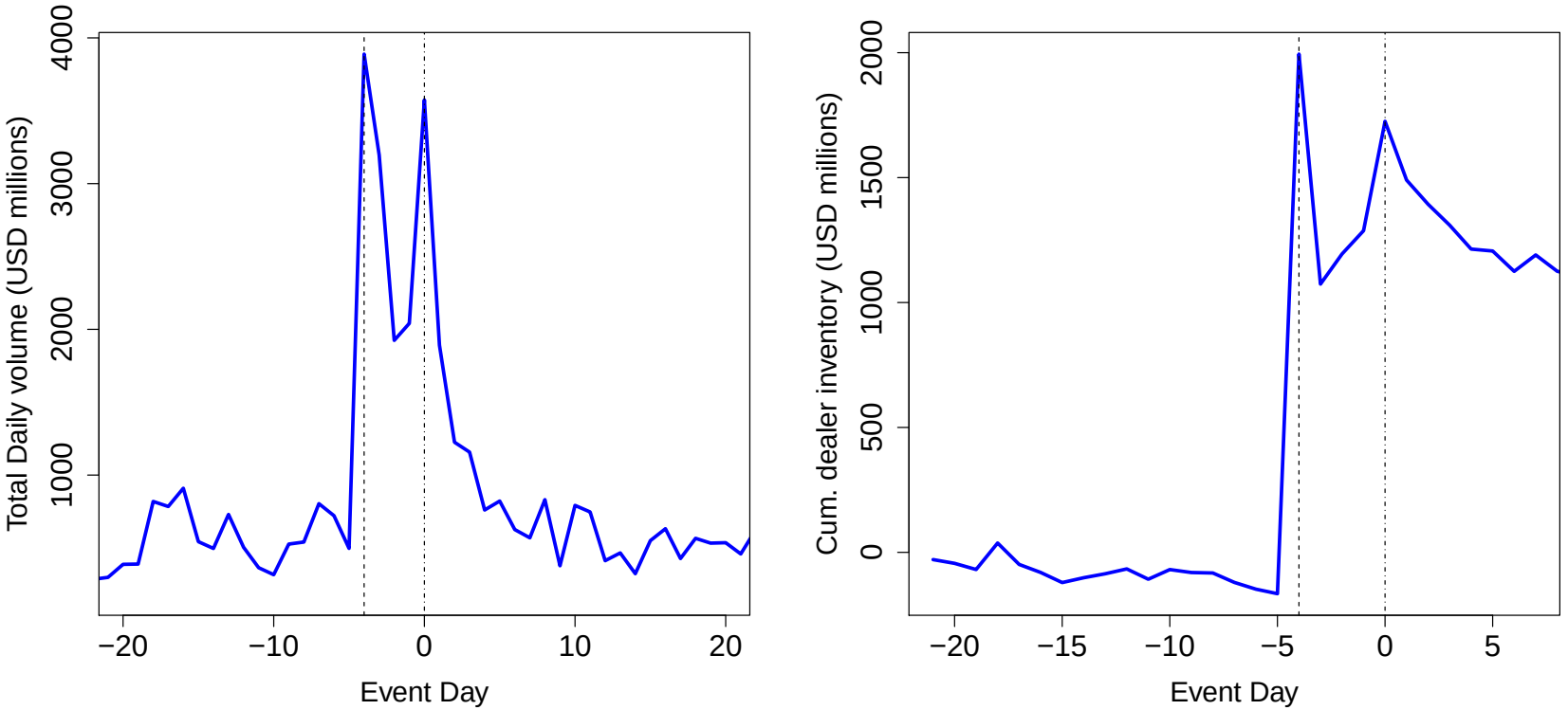


Figure: Downgrade happens at t-4: no time to react!

Downgrade Vs Downgrade Exclusion (t-11)

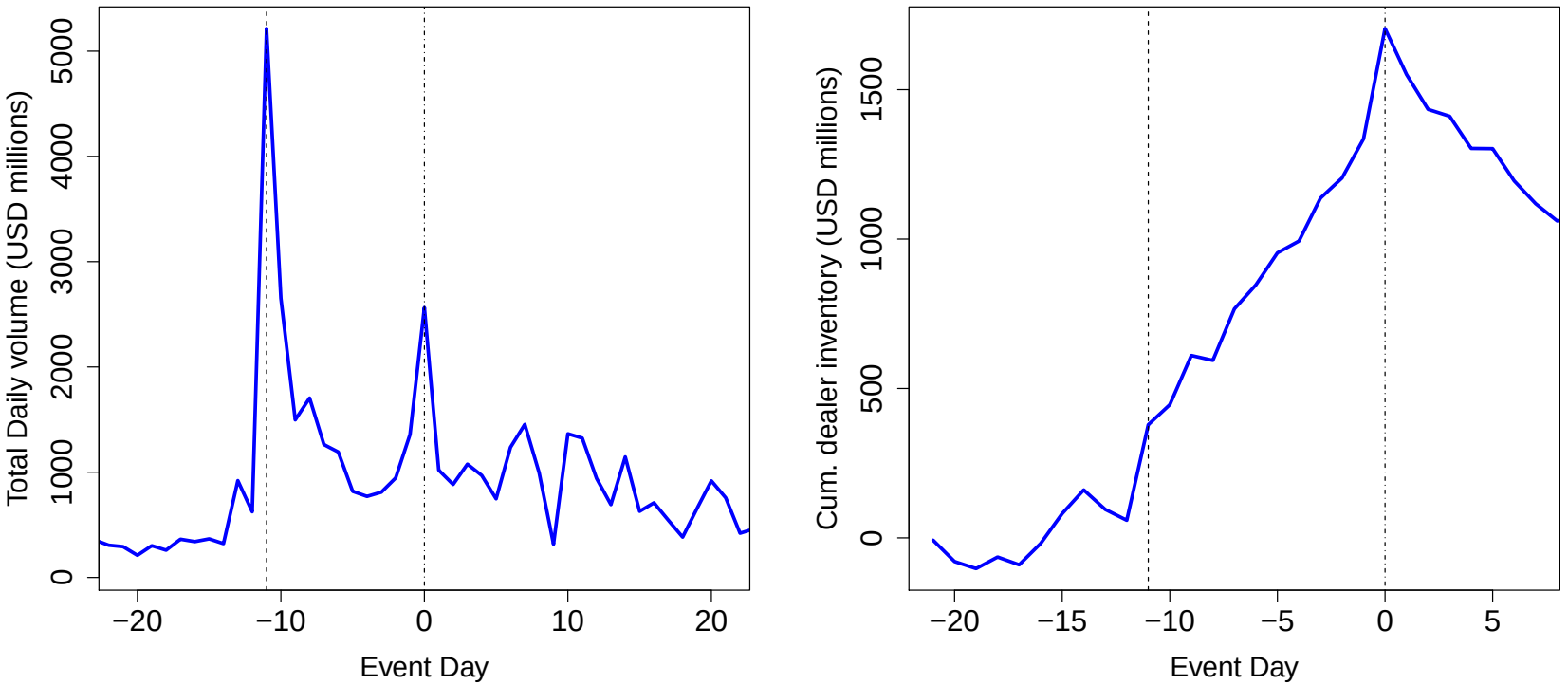


Figure: Downgrade happens at t-11: it is in the past

Downgrade Vs Downgrade Exclusion (t-17)

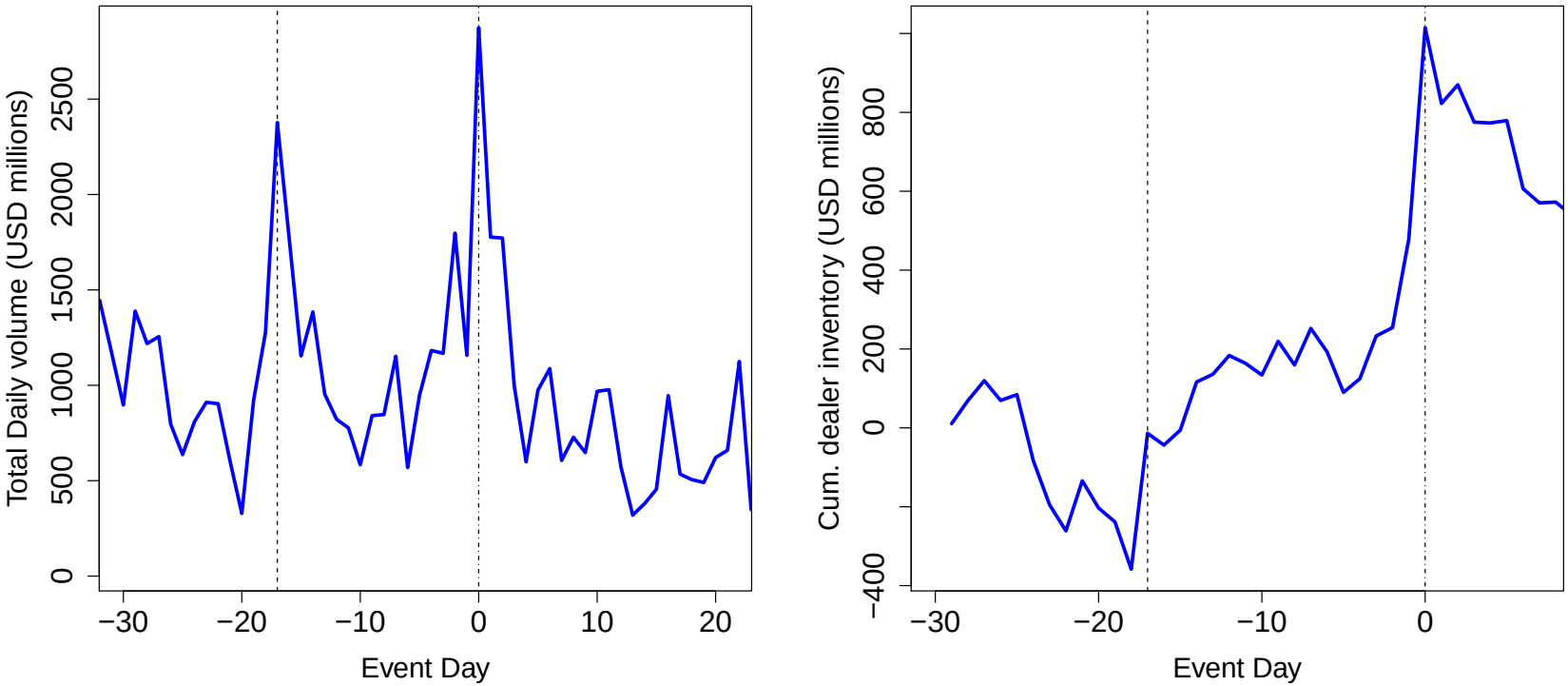


Figure: Downgrade happens at t-17: it is ancient history.

Robustness: Q measured in natural logarithm

Event Window: (0,t]	3	5	20	30
Q*Postcrisis	20.69	30.39	40.54	49.46
	(2.65)***	(2.66)***	(2.36)**	(2.06)**
Q*Crisis	53.25	71.27	66.80	83.76
	(3.32)***	(2.87)***	(2.25)**	(2.24)**
Q*Precrisis	11.86	14.51	5.67	14.62
	(1.55)	(1.75)*	(0.42)	(0.86)
Log Issue Size	-21.07	-13.63	6.23	73.08
	(-1.31)	(-0.54)	(0.23)	(1.34)
Dealer Lev. Growth	-88.22	-84.93	-156.7	-197.0
	(-1.45)	(-0.69)	(-1.04)	(-0.76)
VIX	4.11	3.06	8.21	5.80
	(2.17)**	(1.26)	(2.38)**	(1.10)
TED Spread	1.90	2.28	1.74	3.10
	(3.32)***	(2.76)***	(1.59)	(1.51)
Number of Observations	14993	14634	13401	12919
Adjusted R-Square	0.3427	0.3423	0.4056	0.3281

Robustness: P proxied with purchase price (B_0)

Model	1	2
Q*Postcrisis	-0.07	-0.05
	(-4.04)***	(-4.04)***
Q*Crisis	0.12	0.02
	(2.28)**	(0.41)
Q*Precrisis	-0.01	-0.01
	(-1.35)	(-1.27)
Log Issue Size	2.97	2.63
	(4.70)***	(5.04)***
Coupon	1.52	1.59
	(7.00)***	(7.79)***
Years to Maturity	-0.42	-0.44
	(-3.98)***	(-4.72)***
Dealer Lev. Growth		11.87
		(4.70)***
VIX		-0.28
		(-4.92)***
TED Spread		-0.07
		(-4.61)***
Number of Observations	17415	17415
Adjusted R-Square	0.6381	0.7125

Bibliography I

Adrian, Tobias, Michael Fleming, Or Shachar, and Erik Vogt, 2015, Has u.s. corporate bond market liquidity deteriorated?, *http://libertystreeteconomics.newyorkfed.org/*.

Bessembinder, Hendrik, Stacey Jacobsen, Wiliam Maxwell, and Kumar Venkataraman, 2016, Capital commitment and illiquidity in corporate bonds, Working paper Arizona State University.

Bessembinder, Hendrik, Kathleen M Kahle, William F Maxwell, and Danielle Xu, 2009, Measuring abnormal bond performance, *Review of Financial Studies* 22, 4219–4258.

Dick-Nielsen, Jens, Peter Feldhütter, and David Lando, 2012, Corporate bond liquidity before and after the onset of the subprime crisis, *Journal of Financial Economics* 103, 471–492.

Duffie, Darrell, 2012, Market making under the proposed volcker rule, *Rock Center for Corporate Governance at Stanford University Working Paper*.

Bibliography II

Lucas, Robert E, 1976, Econometric policy evaluation: A critique, in *Carnegie-Rochester conference series on public policy* vol. 1 pp. 19–46. Elsevier.

Richardson, Matthew, 2012, Why the volcker rule is a useful tool for managing systemic risk, *White paper, New York University*.

Trebbi, Francesco, and Kairong Xiao, 2015, Regulation and market liquidity, Working Paper 21739 National Bureau of Economic Research.

The Spillovers, Interactions, and (Un)Intended Consequences of Monetary and Regulatory policies

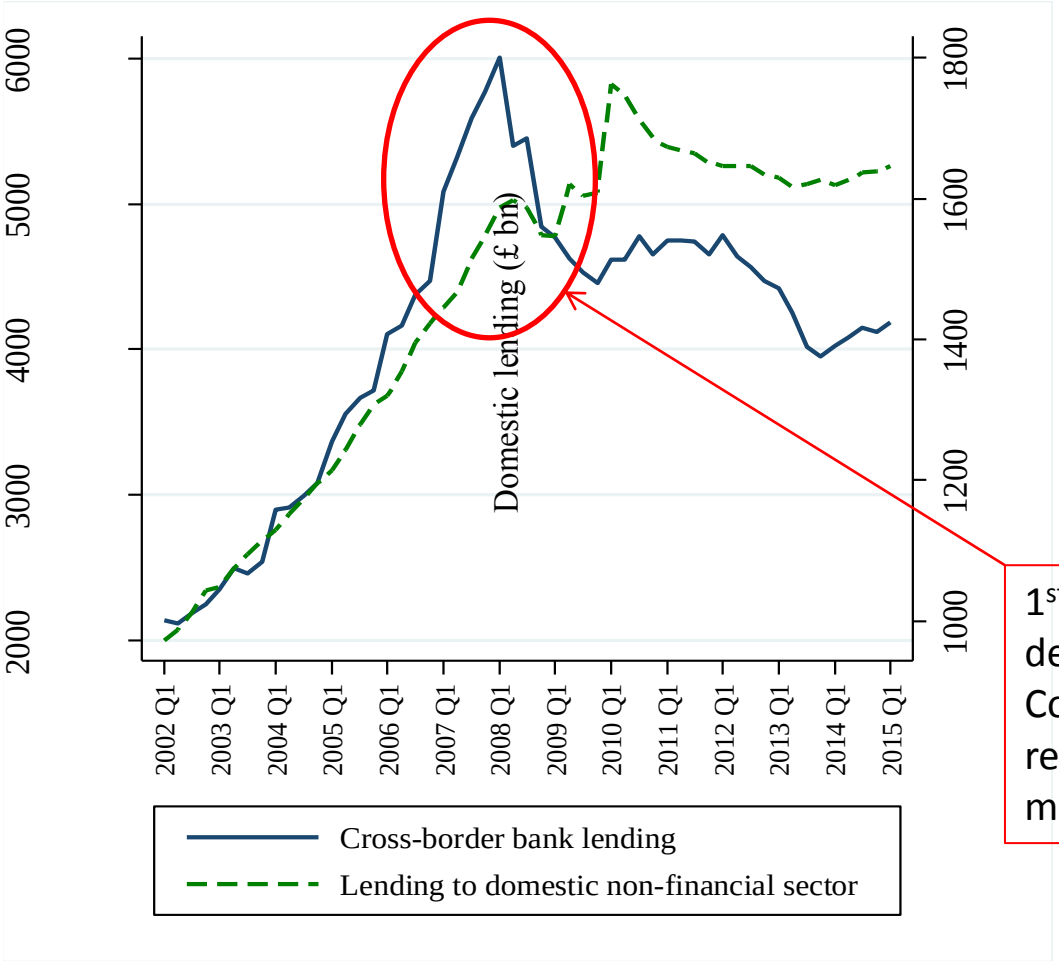
Kristin Forbes (BoE, MIT, NBER), Dennis Reinhardt (BoE) and Tomasz Wieladek (Barclays, CEPR)

29 September 2016

MIT GCFP 3rd Annual Conference - Causes of and Policy Responses to the U.S. Financial Crisis: What Do We Know Now that the Dust Has Settled?

Any views expressed are solely those of the authors and so should not be taken to represent those of the Bank of England or the MPC.

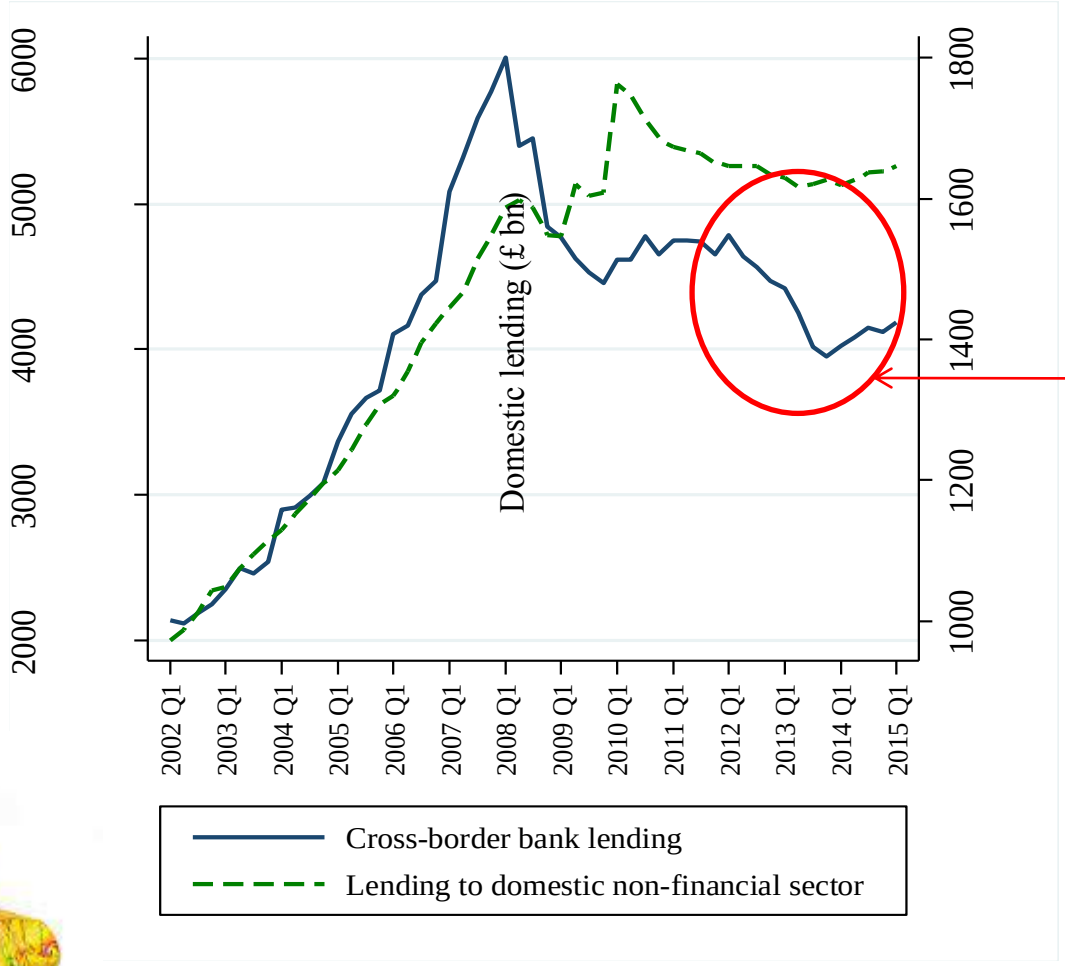
Recent bank lending data show de-globalisation



1st Phase of Banking de-globalisation: Could be in part related to crisis measures

- Similar pattern for both UK (chart) and all BIS reporters.
- … while the share of Portfolio and FDI in total gross inflows has increased after the crisis (see e.g. Bussiere et al. 2016 or Hoggarth et al. 2016).

The 2nd phase of bank de-globalisation



2nd Phase of Banking de-globalisation: Less explored

Possible drivers of banking de-globalisation

(inspired by Forbes, 2014; Bussiere et a. 2016)

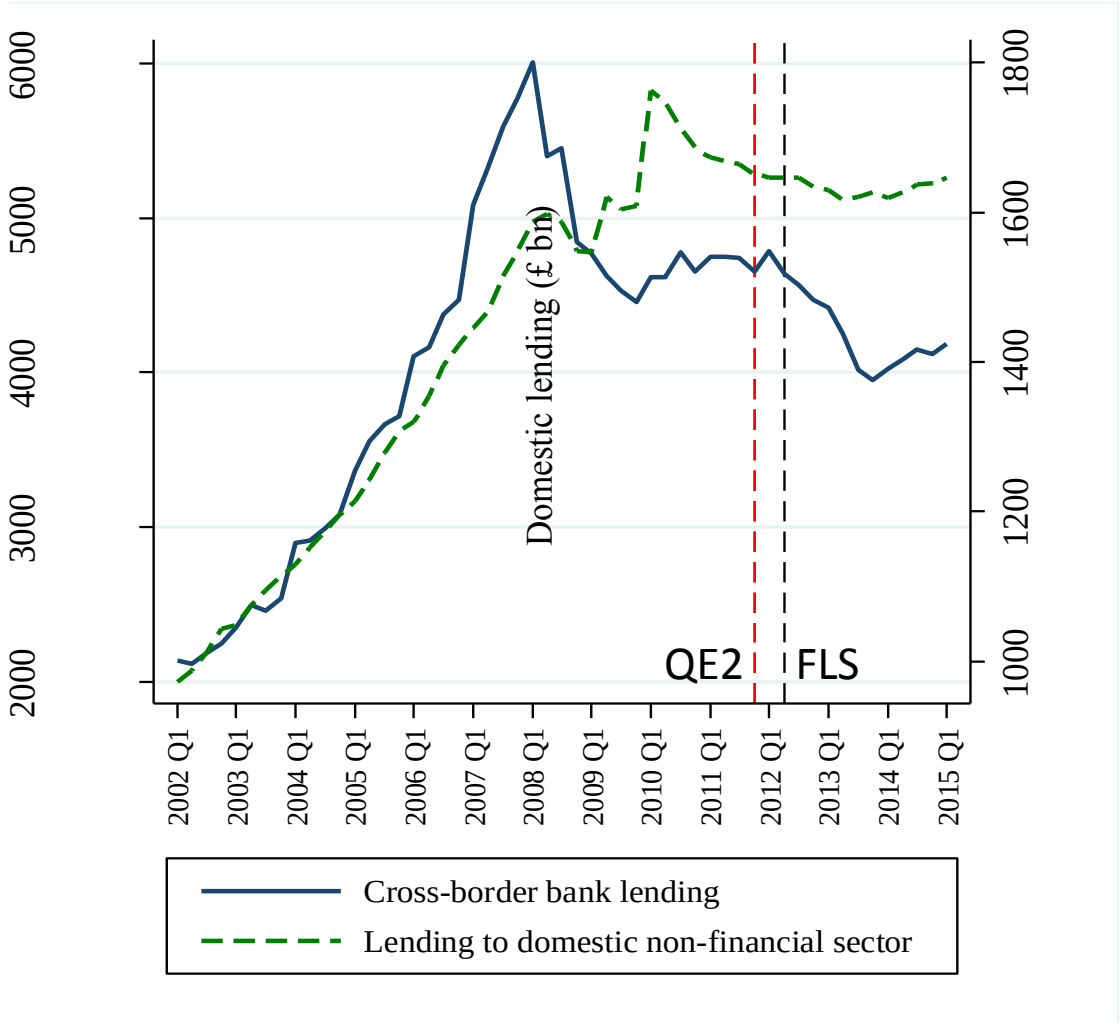
- Weakness in demand for loans/economic activity
- Bank's vulnerabilities, Intragroup frictions (Cerutti & Claessens, 2014), Deleveraging
- Reduced access to wholesale funding
- Flight home effect (Giannetti and Laeven, 2012), Higher costs for banks to go abroad (information asymmetries, monitoring, conduct)
- Political pressure due to banks nationalisation (Rose and Wieladek, 2014; Ongena, Popov and van Horen, 2016)
- Capital controls / Slower pace of liberalisation.
- Effect of regulatory changes and macroprudential measures? In interaction with UMPs?

Regulatory and monetary policies + interactions

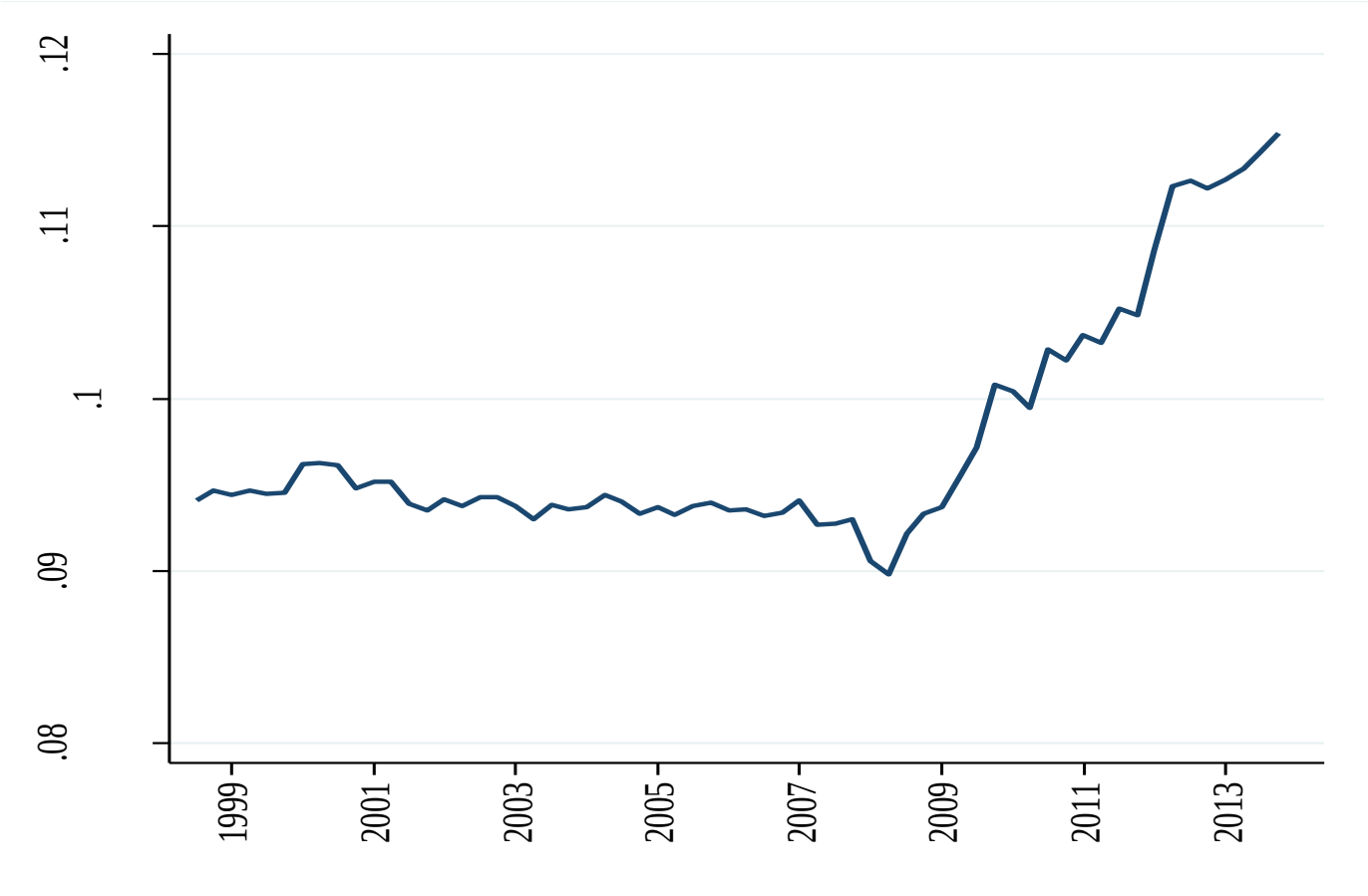
- Host of post-crisis regulatory initiatives to strengthen banks shock absorption capacity
  - Stress testing, Capital and liquidity regulation, Recovery and resolution regimes, Development of macropru policies
- Unconventional Monetary Policies (UMPs)
  - Quantitative Easing, Credit Easing, Forward Guidance
- Regulatory policies can influence the effectiveness of monetary policy and vice versa
  - Bank lending channel depends on: size of banks (Kashyap and Stein, 2000); bank balance sheet composition (Cornett et al. 2011), Global bank linkages (Cetorelli and Goldberg, 2012)

→ This paper: how does the external impact of regulatory policies depend on the presence of UMPs?

2nd phase of de-globalisation coincided with Unconventional Monetary Policies (UMP)…



… and higher capital requirements



- UK regulated banks' total size-weighted capital requirements went up from 9% to 11.5% -- 250 bps a historically unprecedented amount.

Can policy interactions explain de-globalisation?

- **Question**: Can the interaction of capital requirements with UMP explain the second phase of banking de-globalisation?

- **Method**: We use detailed bank data from the UK to test if capital requirement tightening affected external bank lending and if FLS or QE amplified this effect by making this type of lending less attractive (see next slides for channels).

- **Key results:**
  - The *FLS* amplified the negative effects of tighter capital requirements on external bank lending.
  - Limited evidence for *QE*. Amplification not significant for aggregate external bank lending.

Further Literature

- Impact of capital shocks/requirement on lending abroad:
  - Peek and Rosengreen (1997)
  - Aiyar *et al* (2014)
  - Buch and Goldberg (2016): International Bank Research Network findings on transmission of prudential policies.
- External transmission of monetary policy
  - Risk-taking channel (Bruno and Shin, 2015)
  - Ext. bank lending channel (Correa and Murry, 2009)
  - Internal capital markets (Cetorelli and Goldberg, 2012)
- QE spillovers (focused mostly on EMEs)
  - Asset Prices (Bauer and Neely, 2010)
  - Corporate bond issuance (Lo Duca, Nicoletti, Martinez, 2014)
  - Portfolio reallocation, re-pricing of risk (Fratzscher, Lo Duca, Straub, 2015; Correa *et al.* 2015)

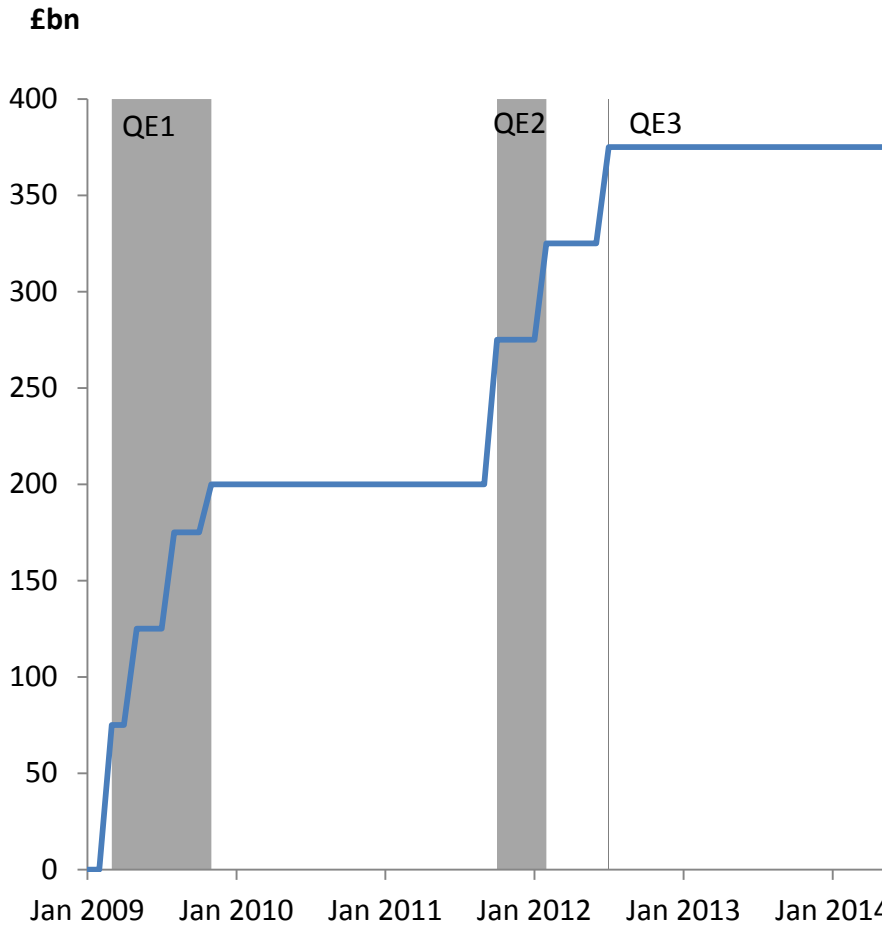
Funding for Lending Scheme (FLS) - Mechanisms

- **Scheme introduced to stimulate bank lending to Households (HH) and PNFCs**
  - For banks that borrow from the FLS, funding costs were decreasing in lending to these sectors
  - Capital offset for FLS-eligible lending *for all UK banks, regardless of their participation in the scheme*
    - i.e. option to offset capital extended in FLS-eligible lending against the capital planning buffer
- **Two phases of the FLS:**
  - **Phase I:** Up to 2013 Q4: HH & PNFC lending was eligible
  - **Phase II:** From 2014 Q1: Only PNFC lending is eligible

FLS - Outcomes

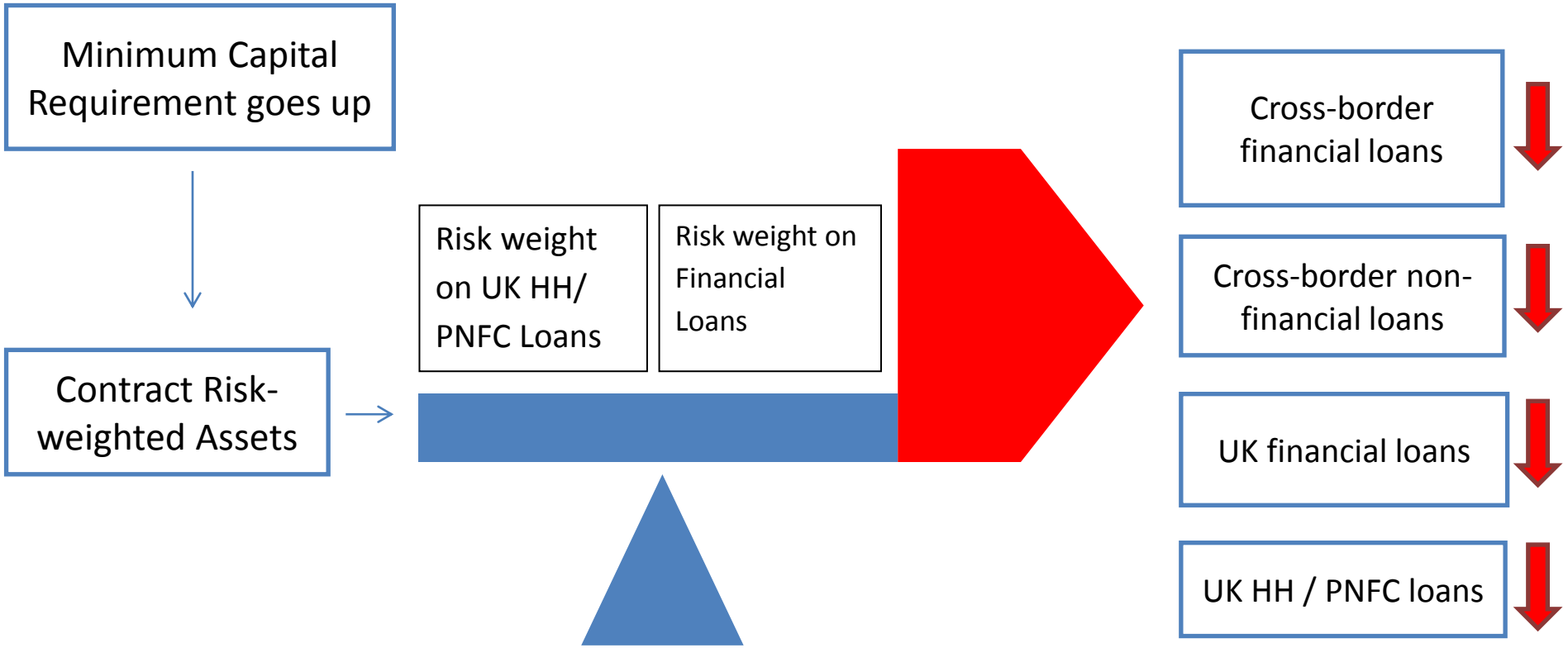
- Churm et al (2015) document a big drop in banking-system wide bank funding costs and sizable impact on GDP (0.5-0.8%)
  - This translated to lower mortgage/PNFC loan rates as well

Quantitative Easing in the UK



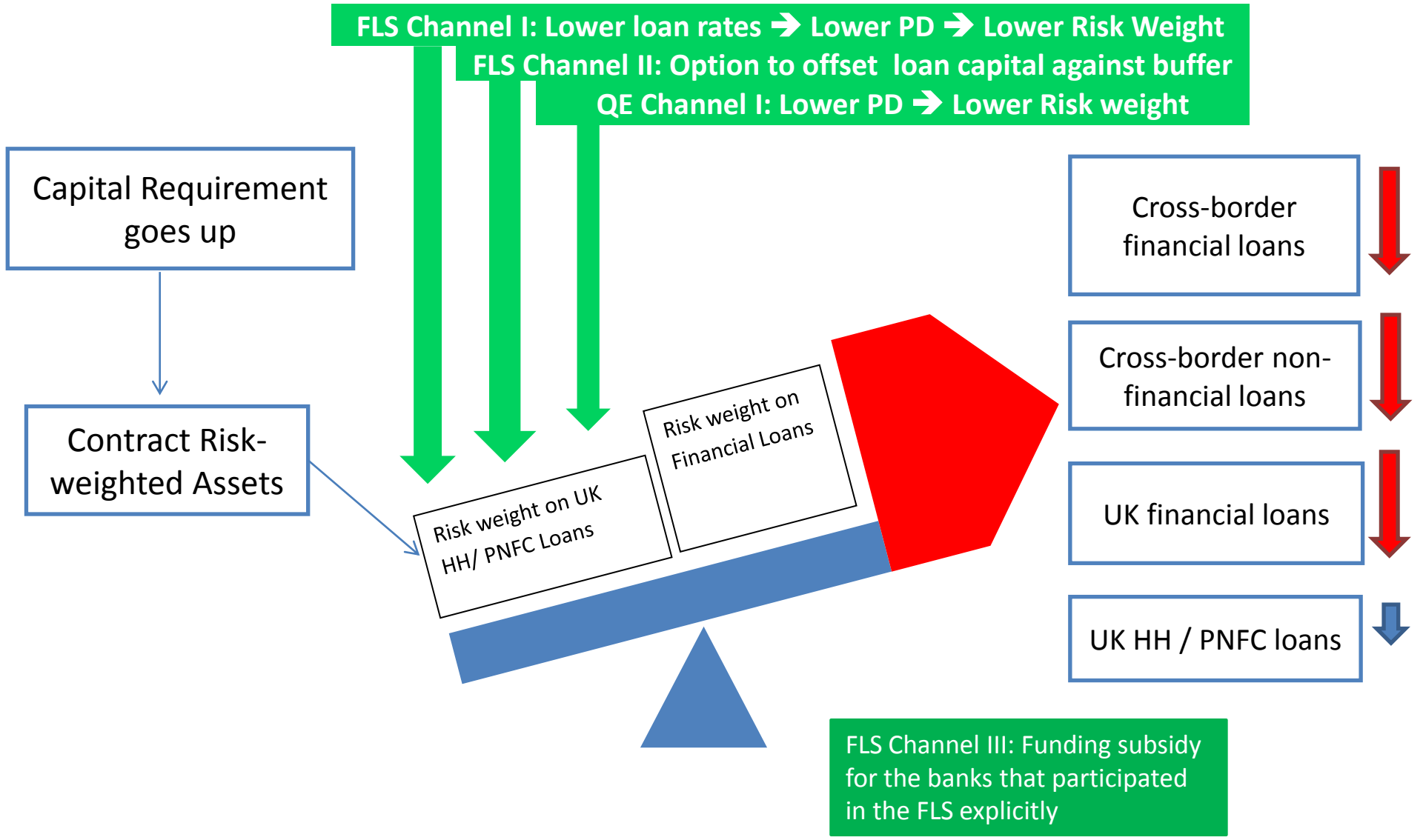
- The MPC announced QE and implemented soon thereafter.
- Credit markets too small, hence mostly focused on sovereign debt

Theory: Capital Requirement Transmission…



Under Basel II, risk weights are internal risk model based (IRB) and a function of borrower probability of default (PD), i.e. Loan interest rate, LTV ratio, unemployment risk, etc.

Theory:… and the FLS/QE



Data

- UK-resident banks' external lending data (CC Forms)
  - The average bank lends to 53 countries
- Regulatory capital requirements data (BSD3, FSA003, COREP)
- Other bank balance sheet variables including bank lending to households and PNFCs (BT, AL)
- Sample period: 1997 Q1 to 2015 Q1.

Regression model

$$\Delta l_{ijt} = \sum_{k=0}^{3} \Delta KR_{it-k} \left(\beta_{t-k} + \delta_{t-k} QE_t + \mu_{t-k} FLS + \rho_{t-k} w_i + \sigma_{t-k}(FLS_t * w_i)\right) + \gamma_t (FLS_t * w_i) + \Lambda F_{jt} + e_{ijt}$$

- where $\Delta \boldsymbol{l_{ijt}}$ is the growth rate of lending by bank *i* to country *j* at time t.
- $\boldsymbol{\Delta KR_{it}}$ is the tightening in bank *i*'s minimum capital requirement (in percent of risk-weighted assets) in quarter t.
- $\boldsymbol{QE_t}$ is the change in the announced flow of asset purchases, scaled by 2009Q1 UK nominal GDP.
- $\boldsymbol{FLS_t}$ is a dummy variable that takes the value of zero until 2012 Q2, 1 thereafter
- $\boldsymbol{w_i}$ is the fraction of FLS-eligible to total lending in 2012 Q2
- $\boldsymbol{F_{jt}}$, the country-specific time fixed effects (controlling for global factors and demand)

Main regression results

		Total External Lending Growth		
		(1)	(2)	(3)
Δ Capital Requirements		-3.394***	-2.136	-3.567*
	p-val	0.00430	0.286	0.0561
Δ Capital Requirements * FLS			4.737*	6.004**
	p-val		0.0778	0.0232
Δ Capital Requirements * Fraction			-0.416	-0.0280
	p-val		0.609	0.973
Δ Capital Requirements * FLS * Fraction			-4.311**	-4.761**
	p-val		0.0225	0.0119
Δ Capital Requirements * QE			-0.784	
	p-val		0.182	
FLS * Fraction			0.00447	0.00463
	s.e		(0.00554)	(0.00554)
Observations		47,421	47,421	47,421
R-squared		0.13	0.135	0.135
Adjusted R-squared		0.0341	0.0356	0.0354
Bank Controls		NO	YES	YES
Bank Fixed Effects		YES	YES	YES
Country-Time-Effects		YES	YES	YES
Cluster		Bank-Time	Bank-Time	Bank-Time

- The FLS amplified the negative effect of KR on external lending.
- QE*KR not significant.

Receiving country characteristics

		Total External Lending Growth					
		(1)	(2)	(3)	(4)	(5)	(6)
Other KR,FLS,QE terms		YES	YES	YES	YES	YES	YES
Δ Capital Requirements * FLS * Fraction		-5.690***	-4.801**	-7.506***	-5.955**	-8.135***	-7.397***
	p-val	0.00155	0.0108	0.00195	0.0172	0.00184	0.00469
Δ Capital Requirements * GDP Growth		-0.498					
	p-val	0.336					
Δ Capital Requirements * Returns		-0.135					
	p-val	0.145					
Δ Capital Requirements * CDS Spread		-0.00731*				-0.00585	
	p-val	0.0813				0.167	
Δ Capital Requirements * Institutional Quality			2.197*			-2.097	
	p-val		0.0832			0.402	
Δ Capital Requirements * Capital Regulation				9.725***		4.624*	5.773**
	p-val			0.00108		0.0799	0.0229
Δ Capital Requirements * LTV				0.339			
	p-val			0.657			
Δ Capital Requirements * Reserve Requirements				-1.401			
	p-val			0.136			
Δ Capital Requirements * Capital Controls					-8.281**	-13.88*	-7.443*
	p-val				0.0487	0.0505	0.0828
Observations		24,358	42,529	11,519	35,078	21,667	28,170
Adjusted R-squared		0.0432	0.0349	0.0477	0.0380	0.0464	0.0457

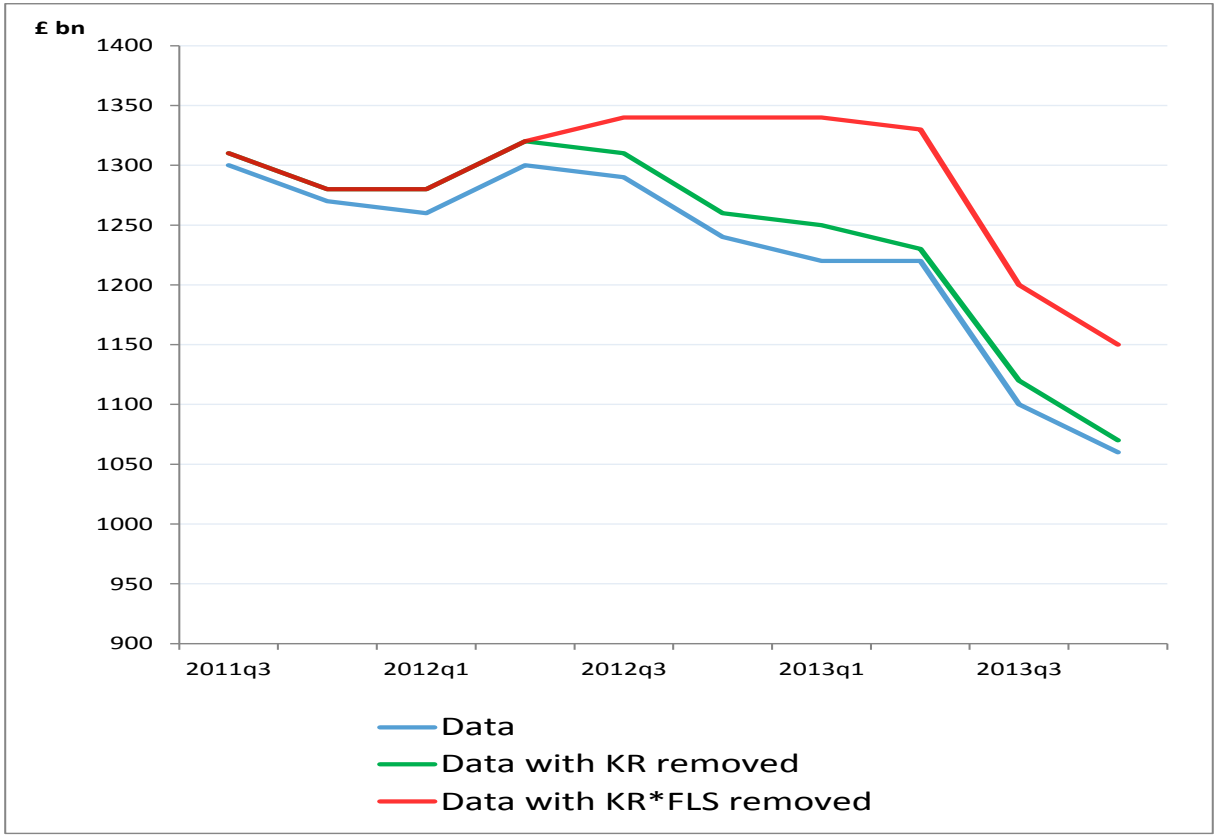
→ After an increase in UK capital requirements, UK banks cut lending more to countries with higher country risk, more capital controls, and weaker institutions

Receiving country characteristics

		Total External Lending Growth					
		(1)	(2)	(3)	(4)	(5)	(6)
Other KR,FLS,QE terms		YES	YES	YES	YES	YES	YES
Δ Capital Requirements * FLS * Fraction		-5.690***	-4.801**	-7.506***	-5.955**	-8.135***	-7.397***
	p-val	0.00155	0.0108	0.00195	0.0172	0.00184	0.00469
Δ Capital Requirements * GDP Growth		-0.498					
	p-val	0.336					
Δ Capital Requirements * Returns		-0.135					
	p-val	0.145					
Δ Capital Requirements * CDS Spread		-0.00731*				-0.00585	
	p-val	0.0813				0.167	
Δ Capital Requirements * Institutional Quality			2.197*			-2.097	
	p-val		0.0832			0.402	
Δ Capital Requirements * Capital Regulation				9.725***		4.624*	5.773**
	p-val			0.00108		0.0799	0.0229
Δ Capital Requirements * LTV				0.339			
	p-val			0.657			
Δ Capital Requirements * Reserve Requirements				-1.401			
	p-val			0.136			
Δ Capital Requirements * Capital Controls					-8.281**	-13.88*	-7.443*
	p-val				0.0487	0.0505	0.0828
Observations		24,358	42,529	11,519	35,078	21,667	28,170
Adjusted R-squared		0.0432	0.0349	0.0477	0.0380	0.0464	0.0457

→ But they cut less to countries with stronger capital regulations (consistent with Avdjiev, Gambacorta, Goldberg and Schiaffi, 2016).

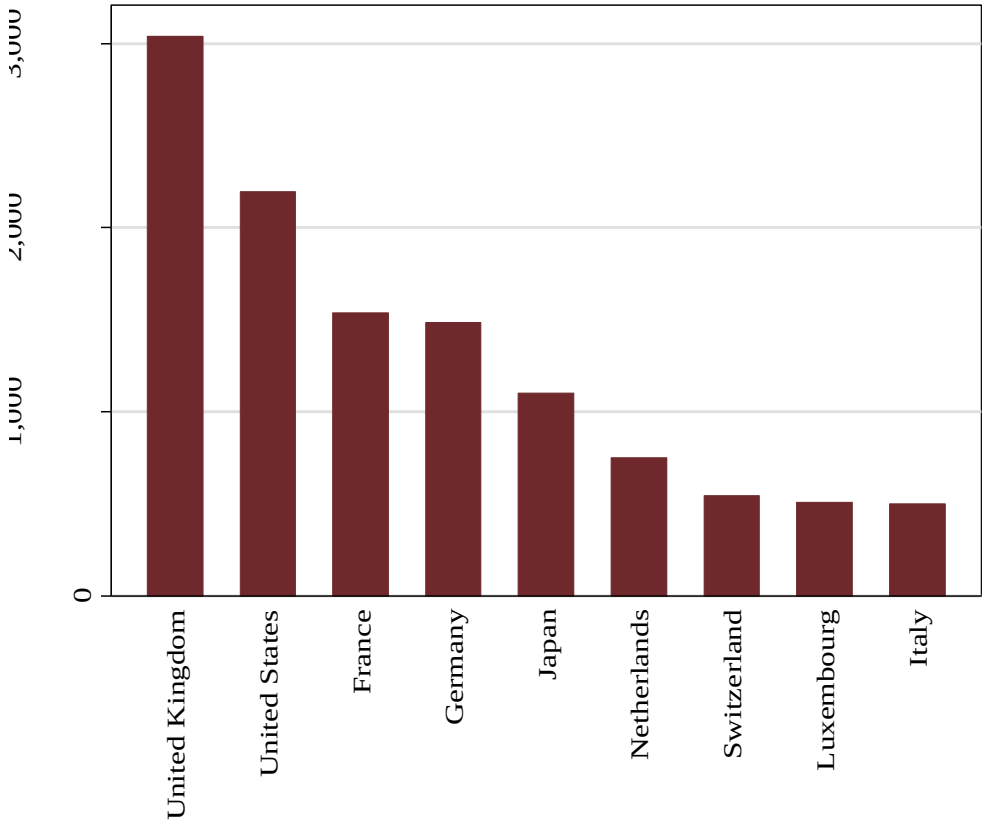
Does this matter?
An aggregation exercise



- We use our model to remove the contribution of the KR tightening and FLS interaction from the data and aggregate up across banks.
- Up to 2013 Q4, the FLS can – in conjunction with higher capital requirements explain around 30% of the total decline in bank to bank lending.

UK policies can have global implications

UK resident banking system largest creditor (among all BIS reporters).



Cross-border banking assets (2012 Q2, USD bn, BIS)

→ From 2012 Q2 to 2013 Q4: Cross-border retrenchment by UK-resident banks accounts for one third of all retrenchment

→ If proportionality holds, the results imply that UK regulatory and monetary policies can directly explain around 10% of the decline in bank to bank flows during the second phase of de-globalisation

Key extensions

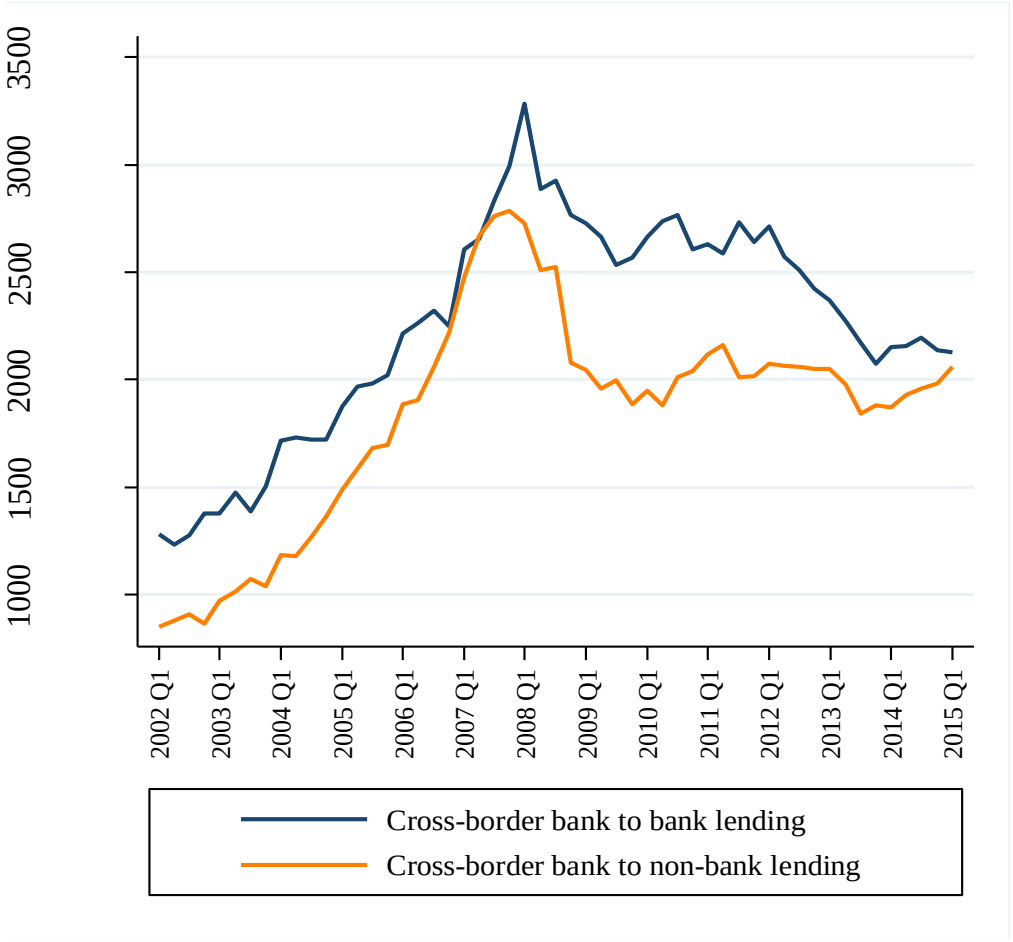
- Different types of external lending: bank-to-bank vs bank-to-nonbank.
- The two phases of the FLS.
- Regulatory changes on liquidity (UK Individual Liquidity Guidance)
- Exogeneity of capital requirements

Conclusions

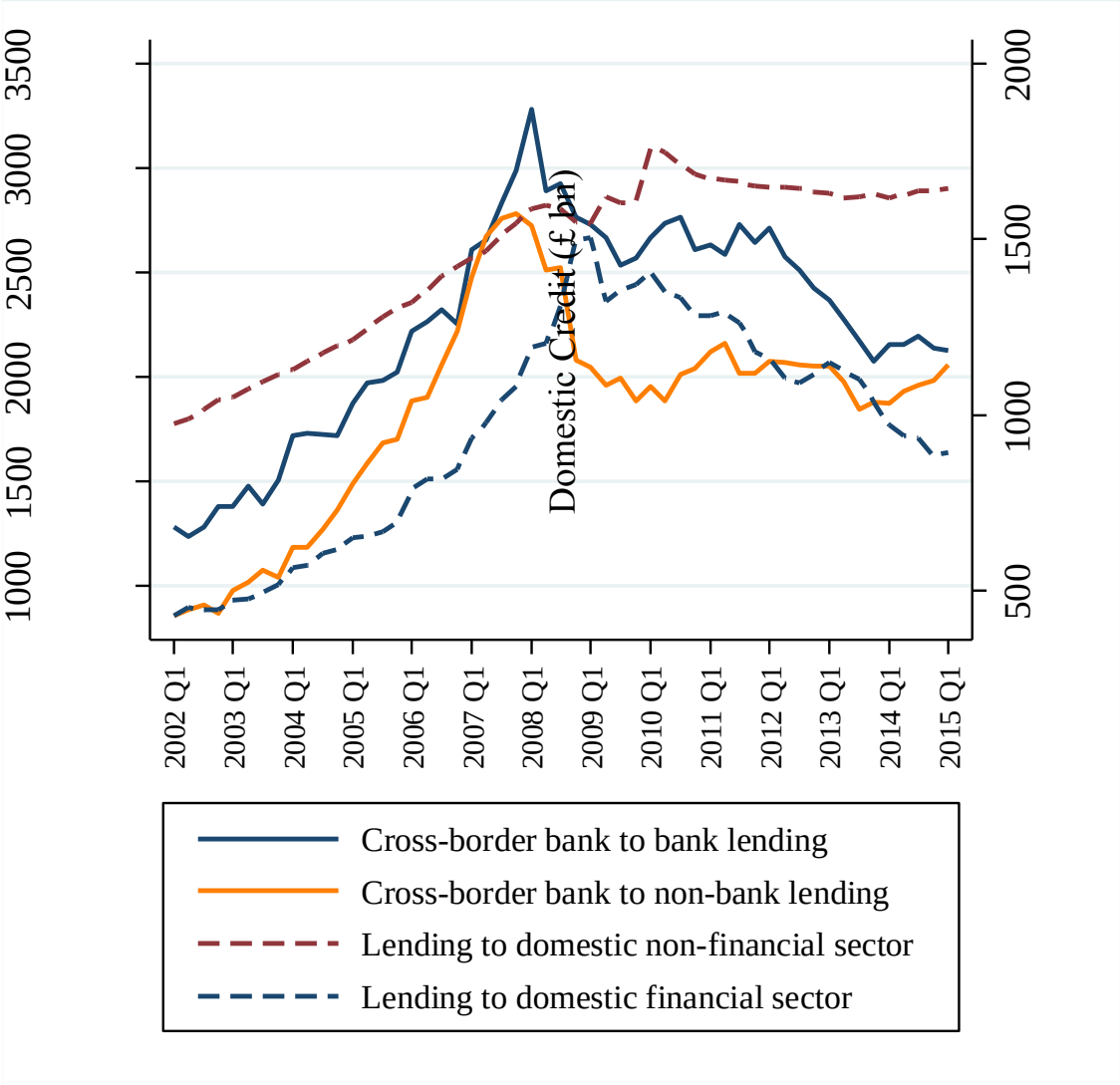
- Although unconventional monetary policies may support domestic lending, some may have, in interaction with KR tightening, the (un)intended consequence of reducing foreign lending
  - Effects may be of course alleviated or offset by the 2nd round effect of UMPs improving domestic growth
- Characteristics of the receiving countries matter for the size of KR spillovers.
- Need to understand the interactions of monetary and prudential policies better

Appendix slides

Bank-to-bank lending vs. bank-to-nonbank lending



Evolution of domestic and external lending



Capital Tightening vs Loosening

		Total External Lending Growth	
		(1)	(2)
		pre-GFC 1997-2007	post-GFC 2010-2015
Δ Capital Requirements Tightening		-6.177***	-4.794***
	p-val	0.00669	0.00560
Δ Capital Requirements Loosening		-2.697	-0.959
	p-val	0.106	0.491
Test if Tightening diff. from Loosening (p-val)		0.207	0.053
Observations		41,792	17,186
Adj. R-squared		0.0468	0.0284
Bank Fixed Effects		YES	YES
Country-Time-Effects		YES	YES
Cluster		Bank-Time	Bank-Time

- In the post-GFC period: Capital requirements loosening less 'binding' than capital tightening

Regression Results

	Total External Lending Growth						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Capital Requirements	-3.394***	-4.014**	-2.570*	-2.430	-2.136	-2.136	-3.567*
p-val	0.00430	0.0272	0.0666	0.209	0.286	0.286	0.0561
Δ Capital Requirements * FLS		5.099*		3.621	4.737*	4.737*	6.004**
p-val		0.0550		0.177	0.0778	0.0778	0.0232
Δ Capital Requirements * Fraction		0.568		-2.332	-2.722	-0.416	-0.0280
p-val		0.914		0.654	0.609	0.609	0.973
Δ Capital Requirements * FLS * Fraction		-28.62**		-24.89**	-28.21**	-4.311**	-4.761**
p-val		0.0169		0.0375	0.0225	0.0225	0.0119
Δ Capital Requirements * QE			-0.781	-0.828	-0.784	-0.784	
p-val			0.156	0.153	0.182	0.182	
FLS * Fraction		0.0170		0.0157	0.0293	0.00447	0.00463
s.e		(0.0362)		(0.0362)	(0.0362)	(0.00554)	(0.00554)
Observations	47,421	47,421	47,421	47,421	47,421	47,421	47,421
R-squared	0.13	0.134	0.133	0.134	0.135	0.135	0.135
Adjusted R-squared	0.0341	0.0343	0.0343	0.0345	0.0356	0.0356	0.0354
Bank Controls	NO	NO	NO	NO	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Country-Time-Effects	YES	YES	YES	YES	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

- Capital requirement tightening affects external lending negatively

Regression Results

	Total External Lending Growth						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Capital Requirements	-3.394***	-4.014**	-2.570*	-2.430	-2.136	-2.136	-3.567*
p-val	0.00430	0.0272	0.0666	0.209	0.286	0.286	0.0561
Δ Capital Requirements * FLS		5.099*		3.621	4.737*	4.737*	6.004**
p-val		0.0550		0.177	0.0778	0.0778	0.0232
Δ Capital Requirements * Fraction		0.568		-2.332	-2.722	-0.416	-0.0280
p-val		0.914		0.654	0.609	0.609	0.973
Δ Capital Requirements * FLS * Fraction		-28.62**		-24.89**	-28.21**	-4.311**	-4.761**
p-val		0.0169		0.0375	0.0225	0.0225	0.0119
Δ Capital Requirements * QE			-0.781	-0.828	-0.784	-0.784	
p-val			0.156	0.153	0.182	0.182	
FLS * Fraction		0.0170		0.0157	0.0293	0.00447	0.00463
s.e		(0.0362)		(0.0362)	(0.0362)	(0.00554)	(0.00554)
Observations	47,421	47,421	47,421	47,421	47,421	47,421	47,421
R-squared	0.13	0.134	0.133	0.134	0.135	0.135	0.135
Adjusted R-squared	0.0341	0.0343	0.0343	0.0345	0.0356	0.0356	0.0354
Bank Controls	NO	NO	NO	NO	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Country-Time-Effects	YES	YES	YES	YES	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

- The FLS amplified this effect.
- Effect seems very large at first sight (bear with me for two slides)

Regression Results

	Total External Lending Growth						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Capital Requirements	-3.394***	-4.014**	-2.570*	-2.430	-2.136	-2.136	-3.567*
p-val	0.00430	0.0272	0.0666	0.209	0.286	0.286	0.0561
Δ Capital Requirements * FLS		5.099*		3.621	4.737*	4.737*	6.004**
p-val		0.0550		0.177	0.0778	0.0778	0.0232
Δ Capital Requirements * Fraction		0.568		-2.332	-2.722	-0.416	-0.0280
p-val		0.914		0.654	0.609	0.609	0.973
Δ Capital Requirements * FLS * Fraction		-28.62**		-24.89**	-28.21**	-4.311**	-4.761**
p-val		0.0169		0.0375	0.0225	0.0225	0.0119
Δ Capital Requirements * QE			-0.781	-0.828	-0.784	-0.784	
p-val			0.156	0.153	0.182	0.182	
FLS * Fraction		0.0170		0.0157	0.0293	0.00447	0.00463
s.e		(0.0362)		(0.0362)	(0.0362)	(0.00554)	(0.00554)
Observations	47,421	47,421	47,421	47,421	47,421	47,421	47,421
R-squared	0.13	0.134	0.133	0.134	0.135	0.135	0.135
Adjusted R-squared	0.0341	0.0343	0.0343	0.0345	0.0356	0.0356	0.0354
Bank Controls	NO	NO	NO	NO	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Country-Time-Effects	YES	YES	YES	YES	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

- The interaction of KR and QE is not significant

Regression Results

	Total External Lending Growth						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Capital Requirements	-3.394***	-4.014**	-2.570*	-2.430	-2.136	-2.136	-3.567*
p-val	0.00430	0.0272	0.0666	0.209	0.286	0.286	0.0561
Δ Capital Requirements * FLS		5.099*		3.621	4.737*	4.737*	6.004**
p-val		0.0550		0.177	0.0778	0.0778	0.0232
Δ Capital Requirements * Fraction		0.568		-2.332	-2.722	-0.416	-0.0280
p-val		0.914		0.654	0.609	0.609	0.973
Δ Capital Requirements * FLS * Fraction		-28.62**		-24.89**	-28.21**	-4.311**	-4.761**
p-val		0.0169		0.0375	0.0225	0.0225	0.0119
Δ Capital Requirements * QE			-0.781	-0.828	-0.784	-0.784	
p-val			0.156	0.153	0.182	0.182	
FLS * Fraction		0.0170		0.0157	0.0293	0.00447	0.00463
s.e		(0.0362)		(0.0362)	(0.0362)	(0.00554)	(0.00554)
Observations	47,421	47,421	47,421	47,421	47,421	47,421	47,421
R-squared	0.13	0.134	0.133	0.134	0.135	0.135	0.135
Adjusted R-squared	0.0341	0.0343	0.0343	0.0345	0.0356	0.0356	0.0354
Bank Controls	NO	NO	NO	NO	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Country-Time-Effects	YES	YES	YES	YES	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

- Initial magnitude seems very large ➔ But shows estimate for a FLS-eligible fraction of 1. Rescaling to the average bank fraction of 0.15, still suggests a sizable effect.

Robustness

Liquid Asset Share	-0.0336
	(0.0223)
Bank Size	0.0225***
	(0.00688)
Commitment Share	0.0394**
	(0.0198)
Deposit Share	-0.0277
	(0.0275)
Writeoffs (Changes)	-0.931**
	(0.451)
Writeoffs (Changes, L)	-0.356
	(0.434)
Writeoffs (Changes, L2)	-0.0556
	(0.409)
Writeoffs (Changes, L3)	-0.575
	(0.414)

- Bank level controls
- Data cleaning, Winsorisation
- Clustering: country-time instead of bank-time
- Restricting sample to larger banks
- Excluding EA banks and lending to EA
- Starting sample period only after the crisis (2008 Q3)
- Placebo tests

Extensions

- The two phases of the FLS.
- Different types of external lending
- Regulatory changes on liquidity
- Exogeneity of capital requirements

The two phases of the FLS

		(1)	(2)	(3)
		Total External Lending	Bank-to-Bank Lending	Bank-to-Non-Bank Lending
Δ Capital Requirements		-1.687	4.616	-1.670
	p-val	0.390	0.122	0.423
Δ Capital Requirements * FLS 1		3.099	0.747	0.949
	p-val	0.280	0.870	0.772
Δ Capital Requirements * Fraction 1		-0.795	-4.904*	-1.534
	p-val	0.644	0.0677	0.464
Δ Capital Requirements * FLS 1 * Fraction 1		-5.801**	-6.829**	-4.640
	p-val	0.0212	0.0126	0.130
Δ Capital Requirements * FLS 2		9.551*	12.13*	4.702
	p-val	0.0757	0.0995	0.396
Δ Capital Requirements * Fraction 2		-0.348	1.910	2.269
	p-val	0.797	0.384	0.175
Δ Capital Requirements * FLS 2 * Fraction 2		-1.597	-2.876	-3.275
	p-val	0.465	0.285	0.187
Δ Capital Requirements * QE		-0.801	-1.028	-1.456**
	p-val	0.168	0.196	0.0289

- The impact of tighter KR is only amplified in the first, but not second, phase of the FLS

Regulatory changes in liquidity requirements

		(1) Total External Lending	(2) Bank-to-Bank Lending	(3) Bank-to-Non-Bank Lending
Δ Capital Requirements		-1.804	4.626	-1.571
	p-val	0.354	0.118	0.445
Δ Capital Requirements * FLS 1		3.735	0.991	1.135
	p-val	0.197	0.826	0.726
Δ Capital Requirements * Fraction 1		-0.754	-4.974*	-1.620
	p-val	0.658	0.0638	0.444
Δ Capital Requirements * FLS 1 * Fraction 1		-6.141**	-6.900**	-4.798
	p-val	0.0160	0.0113	0.121
Δ Capital Requirements * FLS 2		9.668*	12.13*	4.648
	p-val	0.0723	0.0991	0.402
Δ Capital Requirements * Fraction 2		-0.290	2.088	2.358
	p-val	0.829	0.343	0.164
Δ Capital Requirements * FLS 2 * Fraction 2		-1.670	-3.024	-3.319
	p-val	0.444	0.262	0.181
Δ Capital Requirements * QE		-0.764	-0.999	-1.487**
	p-val	0.173	0.206	0.0205
Δ Liquidity Regulation (ILG)		-0.0647**	-0.0242	-0.0539*
	p-val	0.0360	0.660	0.0670
Observations		47,421	29,317	43,051
Adjusted R-squared		0.0359	0.0645	0.0432

- Post-crisis tightening in liquidity requirements could be associated with a decline in external lending.
- In the UK Individual Liquidity Guidance (ILG) introduced from 2010 onwards, but marginally loosened in June 2012/2013.
- Include dummy equal to 1 if requirements were introduced or tightened.

Exogeneity of capital requirements

- Are Pillar 2 capital requirements endo/exogenous?
  - Pillar 1 requirement meant to capture credit and market (Balance sheet) risk
  - *Pillar 2 set at supervisors discretion to capture other risks*
  - ➔ Exogeneity more likely with respect to external lending

- We examine this issue more formally:
  - Examine if 31 regulatory & balance sheet variables can predict Pillar 2 changes in capital requirements
    - Single Regression & Bayesian Model Averaging to choose variables
  - Use residual from this regression, which is orthogonal to balance sheet variables, as a change in KR in baseline model

Predicting capital requirement tightening

	(1)	(2)	(3)
Other operating income	0.596***	0.664***	0.617***
	(0.163)	(0.178)	(0.163)
Financial & Operating Charges	0.461***	0.818***	0.487***
	(0.118)	(0.287)	(0.115)
Domestic real sector lending growth	0.0166***	0.0158**	0.0162***
	(0.00598)	(0.00619)	(0.00607)
External bank lending growth	0.00817	0.00856	
	(0.00899)	(0.00900)	
Realised gains/losses on financial assets & liabilities		2.116	
		(1.287)	
Interest income		-0.356	
		(0.243)	
Constant	0.00943***	0.00910***	0.00930***
	(0.000884)	(0.000879)	(0.000876)
		Model 1	Model 2
Observations	126	126	126
R-squared	0.259	0.299	0.255
Adjusted R2	0.235	0.263	0.237

- Residuals from this regressions should be orthogonal to balance sheet characteristics

Exogeneity of capital requirements

		Total External Lending Growth		
		(1)	(2)	(3)
		Baseline	Model 1	Model 2
Δ Capital Requirements		-0.477	4.440	4.019
	p-val	0.835	0.313	0.350
Δ Capital Requirements * FLS		3.093	9.621	3.137
	p-val	0.332	0.198	0.599
Δ Capital Requirements * Fraction		-0.323	-1.835	-1.676
	p-val	0.860	0.528	0.544
Δ Capital Requirements * FLS * Fraction		-8.129***	-13.97**	-11.33**
	p-val	0.00635	0.0154	0.0252
Δ Capital Requirements * QE		-0.922	-3.434***	-3.038***
	p-val	0.119	0.000377	0.00136
FLS * Fraction		0.00735	-0.00501	-0.00340
	s.e	(0.00843)	(0.00758)	(0.00760)
Observations		13,411	13,411	13,411
Adjusted R-squared		0.0368	0.0369	0.0368
Bank Controls		YES	YES	YES
Bank Fixed Effects		YES	YES	YES
Country-Time-Effects		YES	YES	YES
Cluster		Bank-Time	Bank-Time	Bank-Time

Regressions from 2009 Q3:

- New reporting forms
- Coefficients are larger than in baseline
- KR*QE turns significant

Exogeneity of capital requirements

		Total External Lending Growth	
		(7)	(8)
		Include KR determinants directly - Model 1	Include KR determinants directly - Model 2
Δ Capital Requirements		-1.073	-2.148
	p-val	0.650	0.378
Δ Capital Requirements * FLS		3.804	4.744
	p-val	*0.251*	*0.171*
Δ Capital Requirements * Fraction		0.790	1.190
	p-val	*0.659*	*0.531*
Δ Capital Requirements * FLS * Fraction		-7.134***	-9.356***
	p-val	*0.0137*	*0.00189*
Δ Capital Requirements * QE		-0.941*	-1.062*
	p-val	*0.0991*	*0.0764*
FLS * Fraction		0.0141*	0.00894
	s.e	(0.00819)	(0.00843)
Observations		13,324	13,370
Adjusted R-squared		0.0436	0.0376
Bank Controls		YES	YES
Bank Fixed Effects		YES	YES
Country-Time-Effects		YES	YES
Cluster		Bank-Time	Bank-Time

Including significant predictors of capital requirements directly into the regression yields similar results

Robustness II

		Total External Lending Growth				
		(1)	(2)	(3)	(4)	(5)
		Winsorise at 1%	Winsorise at 5%	Different clustering	Drop small banks	From 2008 Q3
Δ Capital Requirements		-2.112	-1.888	-2.136	-1.913	-0.521
	p-val	0.289	0.289	0.270	0.359	0.812
Δ Capital Requirements * FLS		4.716*	4.231*	4.737*	4.750	2.027
	p-val	0.0781	0.0791	0.0752	0.102	0.453
Δ Capital Requirements * Fraction		-0.410	-0.390	-0.416	-0.486	-0.238
	p-val	0.614	0.595	0.572	0.570	0.840
Δ Capital Requirements * FLS * Fraction		-4.315**	-3.883**	-4.311***	-4.501**	-5.074**
	p-val	0.0222	0.0224	0.00672	0.0202	0.0127
Δ Capital Requirements * QE		-0.783	-0.689	-0.784	-0.821	-1.009*
	p-val	0.182	0.196	0.150	0.188	0.0824
Δ Capital Requirements * FLS * Fraction * EA						
	p-val					
FLS * Fraction		0.00440	0.00294	0.00447	0.00642	0.00622
	s.e	(0.00553)	(0.00500)	(0.00481)	(0.00602)	(0.00553)
Observations		47,421	47,421	47,421	39,677	16,512
Adjusted R-squared		0.0359	0.0386	0.0356	0.0403	0.0302
Bank Controls		YES	YES	YES	YES	YES
Bank Fixed Effects		YES	YES	YES	YES	YES
Country-Time-Effects		YES	YES	YES	YES	YES
Cluster		Bank-Time	Bank-Time	Country-Time	Bank-Time	Bank-Time

Robustness II

		Total External Lending Growth			
		(6)	(7)	(8)	(9)
		Exclude EA banks	Vis-à-vis EA interaction	Switch 'FLS' on 2008 Q3 to 2015 Q1 - **Placebo test**	to 2012Q2 - **Placebo test**
Δ Capital Requirements		-2.403	-2.132	-5.149	-2.625
	p-val	0.240	0.287	0.120	0.427
Δ Capital Requirements * FLS		4.907*	4.752*	1.547	-0.326
	p-val	0.0697	0.0772	0.616	0.909
Δ Capital Requirements * Fraction		-1.211	-0.415	1.003	-2.389
	p-val	0.246	0.611	0.528	0.160
Δ Capital Requirements * FLS * Fraction		-4.319**	-4.229**	-3.311	2.498
	p-val	0.0312	0.0444	0.117	0.197
Δ Capital Requirements * QE		-0.704	-0.785	-1.232*	-1.207**
	p-val	0.243	0.182	0.0190	0.0254
Δ Capital Requirements * FLS * Fraction * EA			-0.317		
	p-val		0.819		
FLS * Fraction		0.00627	0.00448	0.00510	-0.00145
	s.e	(0.00568)	(0.00553)	(0.00443)	(0.00480)
Observations		45,570	47,421	48,489	48,489
Adjusted R-squared		0.0359	0.0355	0.0349	0.0349

- Col (6): exclude affiliates with a parent headquartered in the euro area. Col (7): include dummy for lending to Euro Area.

Robustness II

		Total External Lending Growth			
		(6)	(7)	(8)	(9)
		Exclude EA banks	Vis-à-vis EA interaction	Switch 'FLS' on 2008 Q3 to 2015 Q1 - **Placebo test**	to 2012Q2 - **Placebo test**
Δ Capital Requirements		-2.403	-2.132	-5.149	-2.625
	p-val	0.240	0.287	0.120	0.427
Δ Capital Requirements * FLS		4.907*	4.752*	1.547	-0.326
	p-val	0.0697	0.0772	0.616	0.909
Δ Capital Requirements * Fraction		-1.211	-0.415	1.003	-2.389
	p-val	0.246	0.611	0.528	0.160
Δ Capital Requirements * FLS * Fraction		-4.319**	-4.229**	-3.311	2.498
	p-val	0.0312	0.0444	0.117	0.197
Δ Capital Requirements * QE		-0.704	-0.785	-1.232*	-1.207**
	p-val	0.243	0.182	0.0190	0.0254
Δ Capital Requirements * FLS * Fraction * EA			-0.317		
	p-val		0.819		
FLS * Fraction		0.00627	0.00448	0.00510	-0.00145
	s.e	(0.00568)	(0.00553)	(0.00443)	(0.00480)
Observations		45,570	47,421	48,489	48,489
Adjusted R-squared		0.0359	0.0355	0.0349	0.0349

- 'Placebo tests'. Col (8): switch on FLS dummy in 2008 Q3. Col (9): let dummy run only until 2012 Q2. → result not a 'post-crisis' effect

Variable	Transformation	(1) Coefficient	(2) PIP
Constant		0.00934***	
		(0.000939)	
Financial and Operating Income	Annual Growth	-0.00256	0.08
		(0.0540)	
Interest income	Annual Growth	-0.0818	0.22
		(0.230)	
Fee and commission income	Annual Growth	-0.00573	0.06
		(0.0913)	
Realised gains/losses on financial assets & liabilities	Annual Growth	0.943	0.34
		(1.523)	
Other operating income	Annual Growth	0.0152	0.09
		(0.169)	
Other operating income	Current Growth	0.468	0.74
		(0.339)	
Financial & Operating Charges	Annual Growth	0.541*	0.95
		(0.278)	
Other costs	Annual Growth	0.00913	0.08
		(0.0607)	
Impairment/Provisions	Annual Growth	0.0461	0.12
		(0.163)	
Impairment/Provisions	Current Growth	-0.000106	0.05
		(0.0277)	
Write-offs	Annual Growth	0.00155	0.05
		(0.0662)	
Foreign currency Risk (PRR, stan. approach)	Lagged Growth	0.0836	0.07
		(0.495)	
Position, FX and commodity risk (internal models)	Lagged Growth	-0.0473	0.08
		(0.221)	
Position, FX and commodity risk (internal models)	Current Growth	0.0297	0.07
		(0.193)	
Pillar 1 credit risk capital component	Lagged Growth	0.00327	0.05
		(0.0376)	
External bank lending growth	Annual Growth	0.000758	0.08
		(0.00400)	
External bank-to-bank lending growth	Annual Growth	0.000167	0.06
		(0.00200)	
Domestic real sector lending growth	Annual Growth	0.000125	0.05
		(0.00239)	
Domestic real sector lending growth	Current Growth	0.0150***	0.96
		(0.00520)	

- Bayesian Model Averaging
- Evaluation of 500,000 models.

“Regulatory Changes and Their Consequences”

Discussion by Chester S. Spatt

Tepper School, Carnegie Mellon University

“Cause of and Policy Responses to the U.S. Financial Crisis: What do We Know Now that the Dust Has Settled?”

Golub Center for Finance & Policy, MIT

September 29, 2016

Causality

- Causal effects of liquidity and liquidity regulation are a central issue in the aftermath of the financial crisis
  - Impact on monetary policy and global lending
- Causality (distinguishing alternative hypotheses, identification, etc.) is often challenging—good instruments can be difficult to obtain

“Natural” Experiments

- One broad approach to which I have been a strong advocate are natural experiments (random assignment and eligibility).
  - E.g., for liquidity from CPFF in the crisis
- While there are limitations to such approaches, these are viewed as the “gold standard” in research design.
- This is up to the regulators: the Fed, Bank of England, SEC-- rather than researchers
  - Crucial for maximal long-run policy benefit

Important to Learn

- Theme for the conference is terrific
- Not sure there has been enough attention to learning from the financial crisis
  - Crises are so important, but limited samples
- Not sure whether learning has always been a high enough regulatory priority
  - CPFF example (policy cum research design)
    - Regulators should design tools to learn—info scarce
  - Resistance to Bloomberg's Maiden Lane suit

"The Effects of Liquidity Regulation on Demand and Monetary Policy Operations"

- Potential for a natural experiment: How does Liquidity Coverage Ratio (LCR) impact the Term Deposit Facility (TDF)?
- Perhaps the authors can influence regulatory decision makers
  - Practice should be "ahead" of theory
- Paper does a nice job given the elements in the design and potential endogeneity—diff-in-diff; threshold, early withdrawal, foreign v. domestic bank

Varying Contexts

- Liquidity in different situations
  - Monetary policy
  - Cost of trading bonds and portfolio liquidity
  - Feedback effects
- When are we studying liquidity in these papers?
  - Normalization of policy
    - How do we exit? (Current challenge)
  - Liquidity in “the crisis”

Liquidity Interactions

- Was “the crisis” a liquidity event or a capital/solvency issue?

  --Different mechanisms

- Liquidity changes have consequences

  --Alters demand for excess reserves

  --Volcker Rule and limited bond market liquidity as a response to the crisis; Do we want to enhance liquidity in crises (benefit to mitigate fire sales)?

  --Reduce liquidity to control risk-taking! Volcker tradeoff

  --Supporting domestic liquidity/lending can reduce global lending

Equity vs. Bond Index Funds

- Measure trading costs by impatience in index exclusion events
  - Should we focus on extreme impatience?
- Equity and bond contexts very different
  - Exact replication vs. sampling
  - 20% of bond fund invested “outside index”! (?)
  - Tracking errors very different—e.g., 2.7 b.p. for BGI S&P500; 23.5 for Vanguard Total Bond Market Index Fund

Impatience & Bond Index Funds

- Can we measure impatience in same way for bond and equity index funds?--Doubtful
- “Lack of transparency makes it even more important for the funds to keep a low tracking error” (??)
  - Greater deviation suggests more scope to manage costs rather than tight tracking errors from moral hazard/agency perspective
  - Loose adherence on trade timing, impatience
  - Analogy to ETF issue

More on Impatience

- While I agree that reduced inventory typically suggests less liquidity and greater costs of impatience, it could be that technology change allows less inventory (higher turnover of it) and greater liquidity!
  - Efficiency--Inventory tradeoff not needed be as earlier?
- A better fit for the story in the paper is that the Volcker rule has caused substitution away from using dealer inventory and to pre-arranged trades with customer liquidity

“Funding for Lending Scheme” and Globalization

- Measures to raise domestic lending are not free in terms of economic performance
- Substitution effects (“crowding out”) that reduce cross-border lending are significant
- Analogy to monetary policy across nations
  - Other countries damaged (foreign exchange effect); measures to promote financial stability not simple—”beggar thy neighbor”
- “Crony capitalism” and supporting particular investments at other’s expense

Interaction with Higher Capital

- To the extent that global lending is reduced, it is natural that higher capital standards (less bailout possibility, so reduced risk taking) leads to larger cuts in lending to countries with higher risk
- Explanation for receiving country results
- Since bank-to-bank lending is especially risky, that's why there also is a larger contraction there.

Cross-country effects

- These worth more study
- Paper notes different countries altering policy regime at same time
- Interactions across countries potentially important
  - regulatory spillovers, negative externalities
  - nature of equilibrium

“Unintended Consequences”

- *“Unintended consequences”*
  - Often used in D.C.
  - Are these outside the motives of the regulation?
  - Secondary consequences?
  - Unimportant consequences?
  - Can they be *unexpected*, if discussed in a regulatory proposal?