Repo Market Functioning: The Role of Capital Regulation

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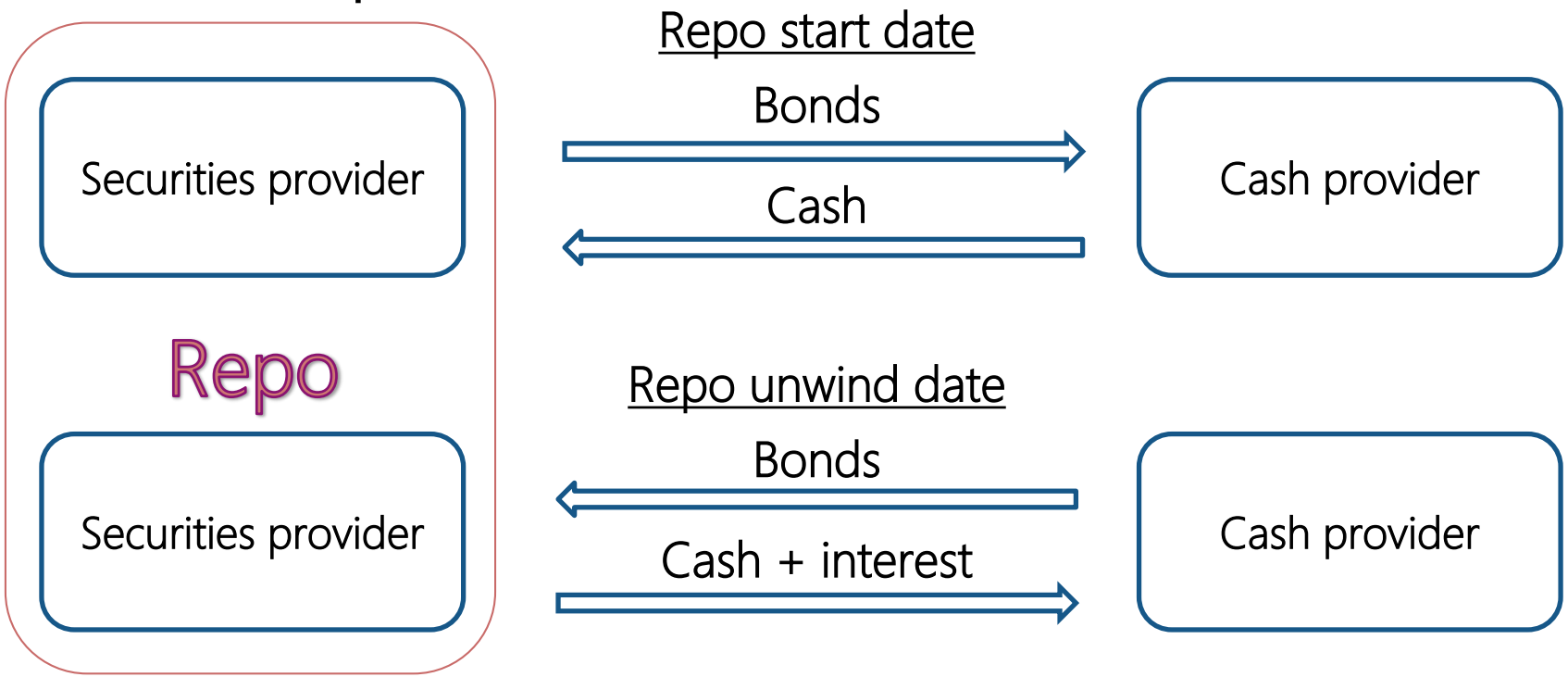
Question: How does the LR affect repo activity?

Leverage ratio → Repo market

What is repo?



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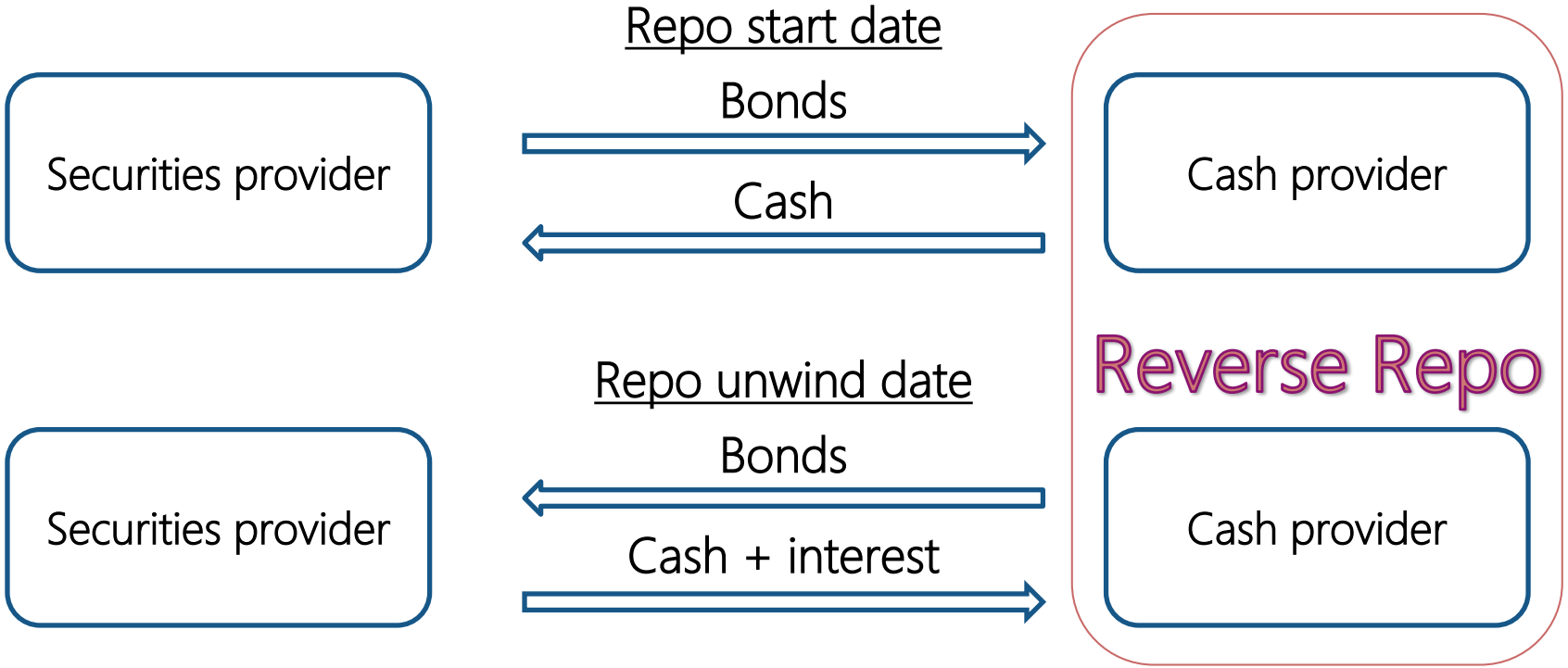
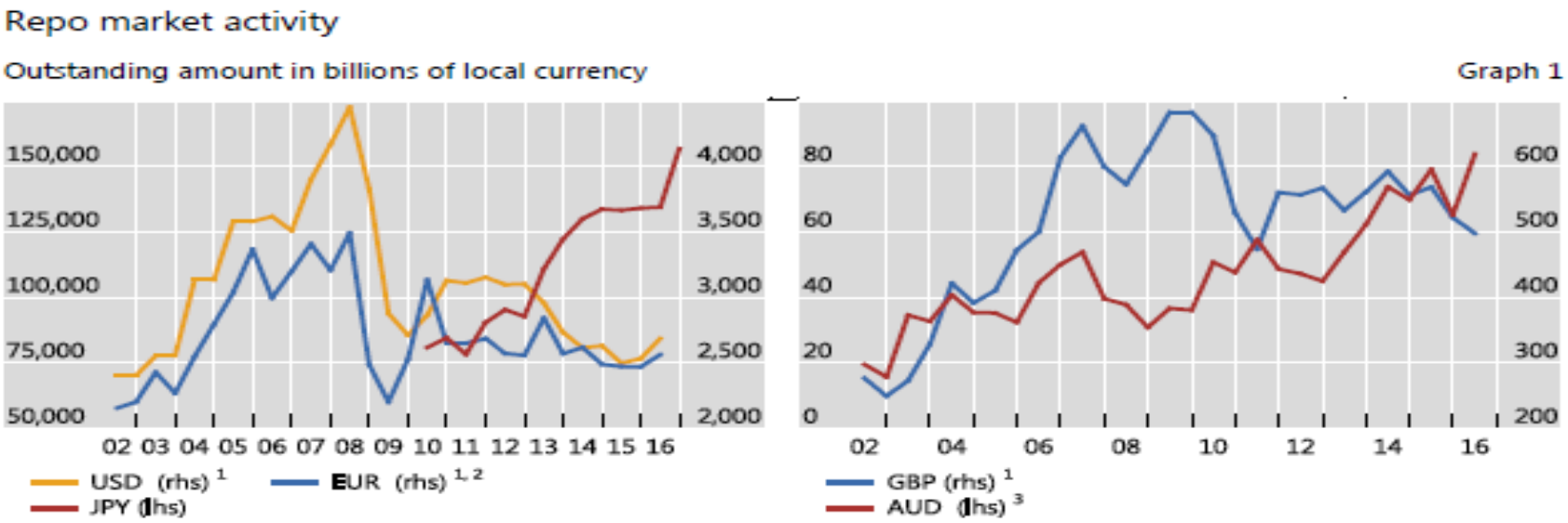
What is repo?


Repo start date
Bonds
Cash
Securities provider
Cash provider
Reverse Repo
Repo unwind date
Bonds
Cash + interest
Securities provider
Cash provider

Why should we care about the repo market?

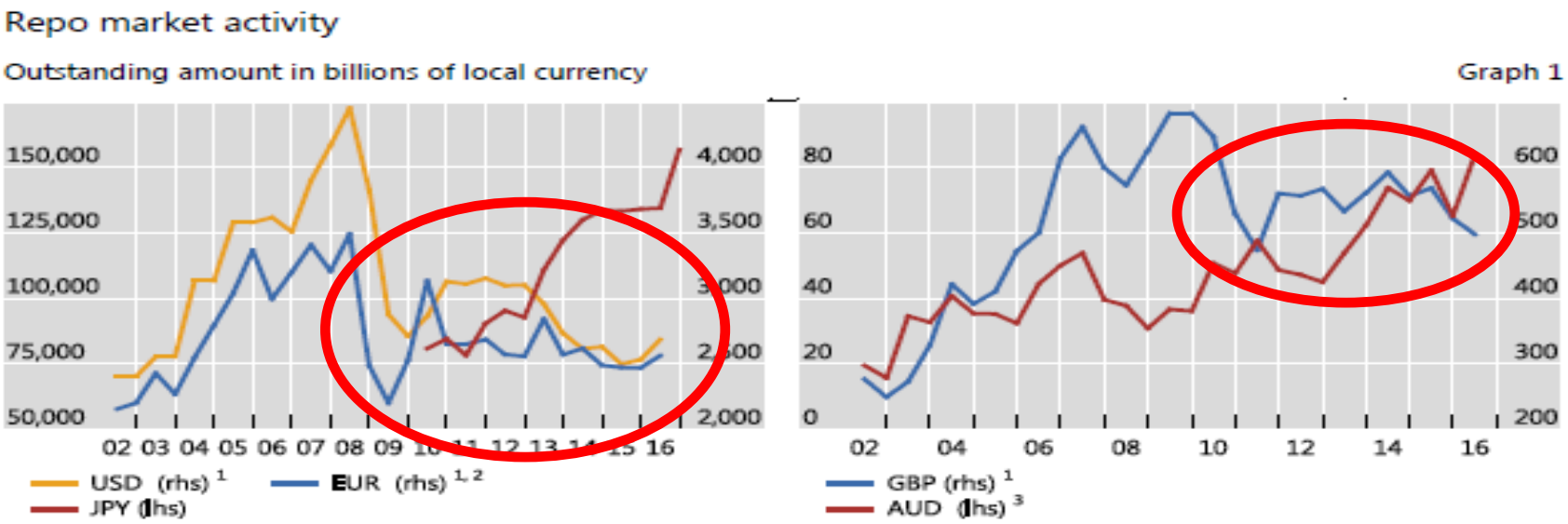
- Facilitates flow of cash and securities
- Important for financial stability and monetary policy
- Very large market (12 trillion US$)

Concerns among Policymakers: *Low Liquidity*



Source: CGFS report on Repo market functioning

Concerns among Policymakers: *Low Liquidity*



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Concerns among Policymakers: *Low Liquidity*

Benoît Cœuré (Member of the Executive Board of the ECB):

"I would like to discuss two factors that have been recently highlighted by market observers, practitioners and academics alike as potentially challenging the intermediation capacity of repo markets, namely central bank asset purchases and post-crisis prudential regulation"

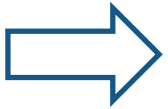
European Repo and Collateral Council General Meeting on "The repo market: market conditions and operational challenges", Brussels, 14 November 2017

Doing Repos and the Leverage Ratio

Leverage ratio

Capital / Total Assets

Same Treatment to Risky and Safe Assets



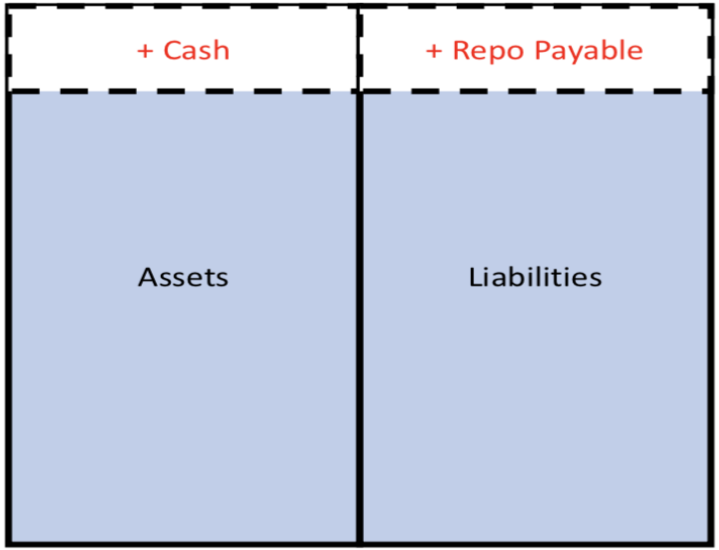
Repo market

Safe/Low Margin Activity

Counts Towards Balance Sheet

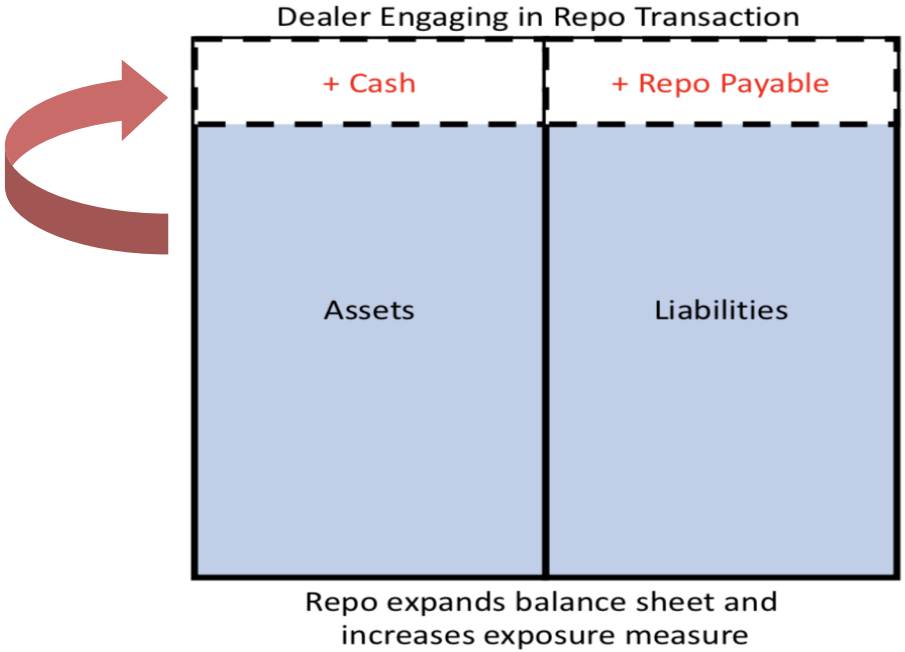
Doing Repos and the Leverage Ratio

Dealer Engaging in Repo Transaction

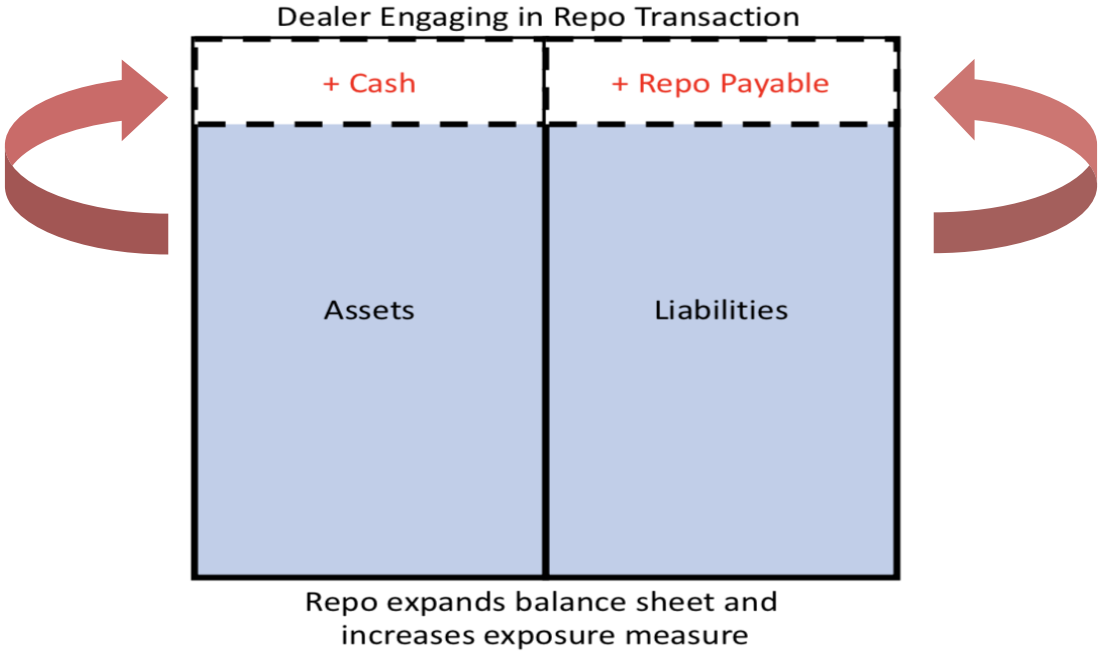


Repo expands balance sheet and increases exposure measure

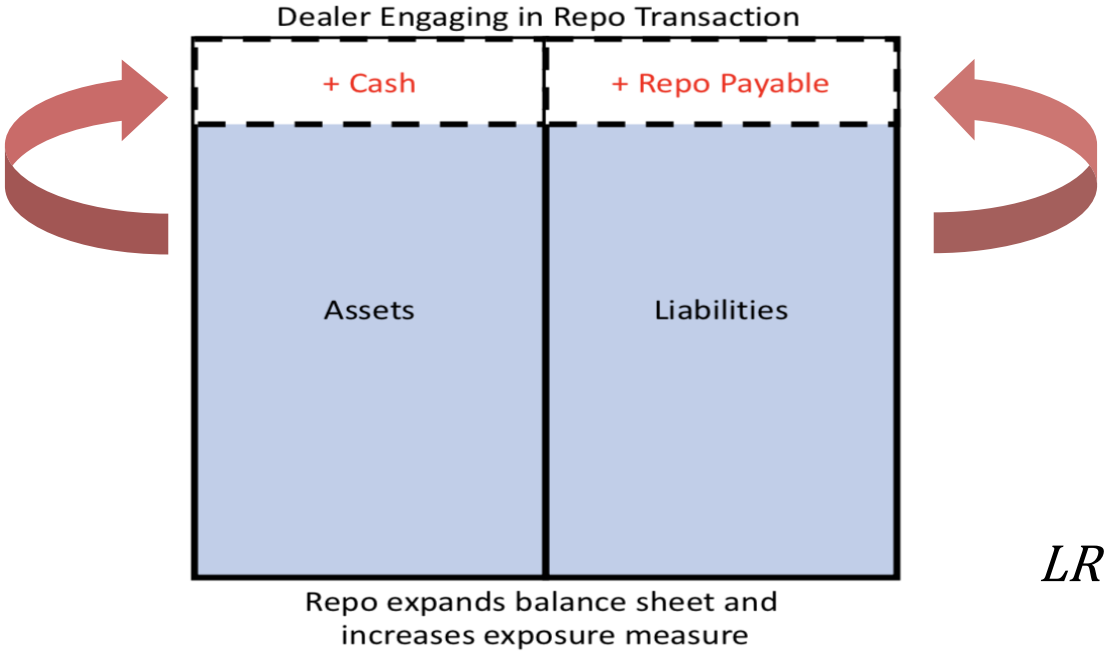
Doing Repos and the Leverage Ratio



Doing Repos and the Leverage Ratio



Doing Repos and the Leverage Ratio



$$LR = \frac{Capital}{Total\ Assets}$$

Question: How does the LR affect repo activity?

Leverage ratio → Repo market

If Anything, Repo Activities Become More Costly Under the LR

However, identification is <u>not easy</u>:

- Exogenous variation in capital regulation
- Distinguish supply from demand
- No other shocks at the same time

This paper

- Quasi-natural experiment – policy change in *reporting* requirement of the LR in UK
- Universe of supervisory repo transactions – dealer and client IDs observable
- No other shocks at the same time

Preview of Findings

- Aggregate:
  - affected dealers reduce repo liquidity
- Heterogeneous:
  - the drop more pronounced for small clients
- Total Market Liquidity:
  - foreign dealers step in to fill the void - market resilient

Quasi–natural experiment

Change in reporting requirement of the LR in the UK

January 2016: Introduction 3% LR - 7 stress-tested UK banks

until December 2016: report every quarter the average of month-ends (“monthly averaging”) – window-dressing incentives

after January 2017: report every quarter the average of all days (“daily averaging”) – no window-dressing incentives

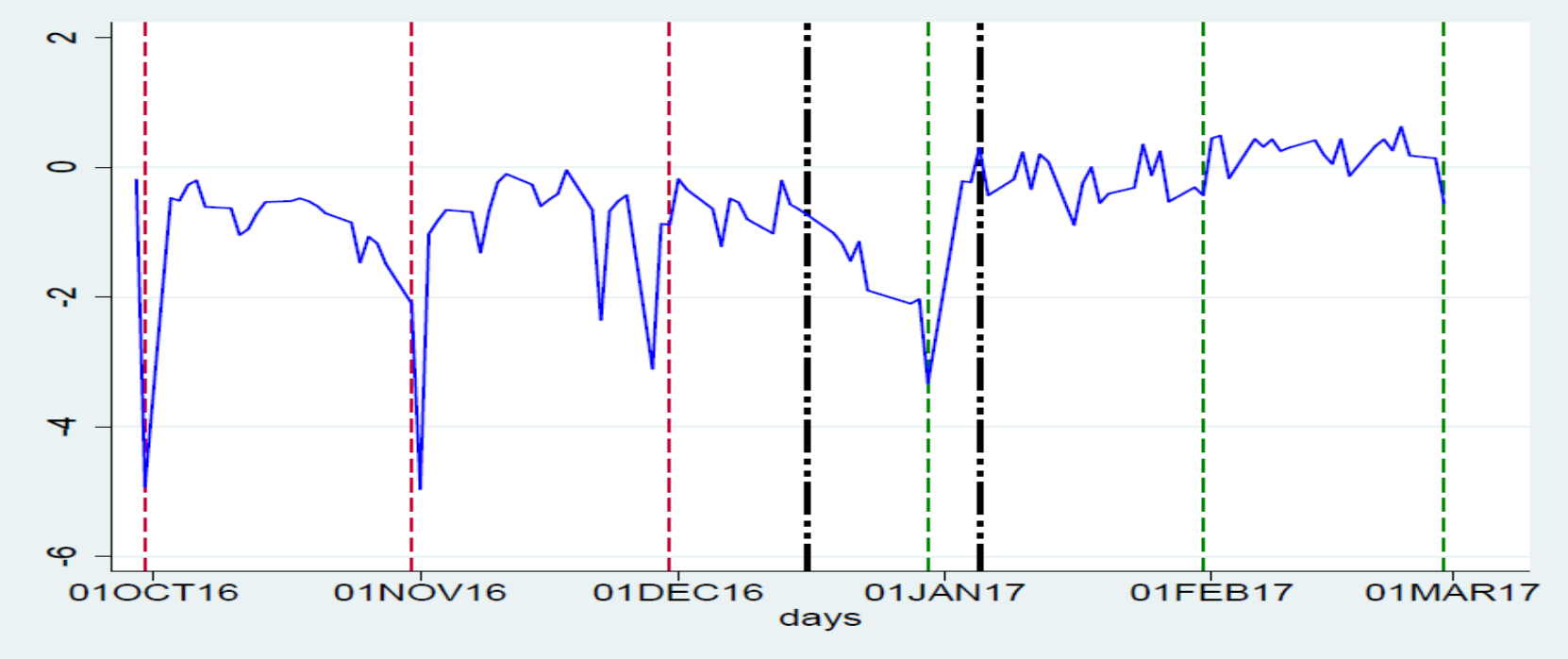
Tightening of the LR– no regulatory arbitrage

Quasi–natural experiment

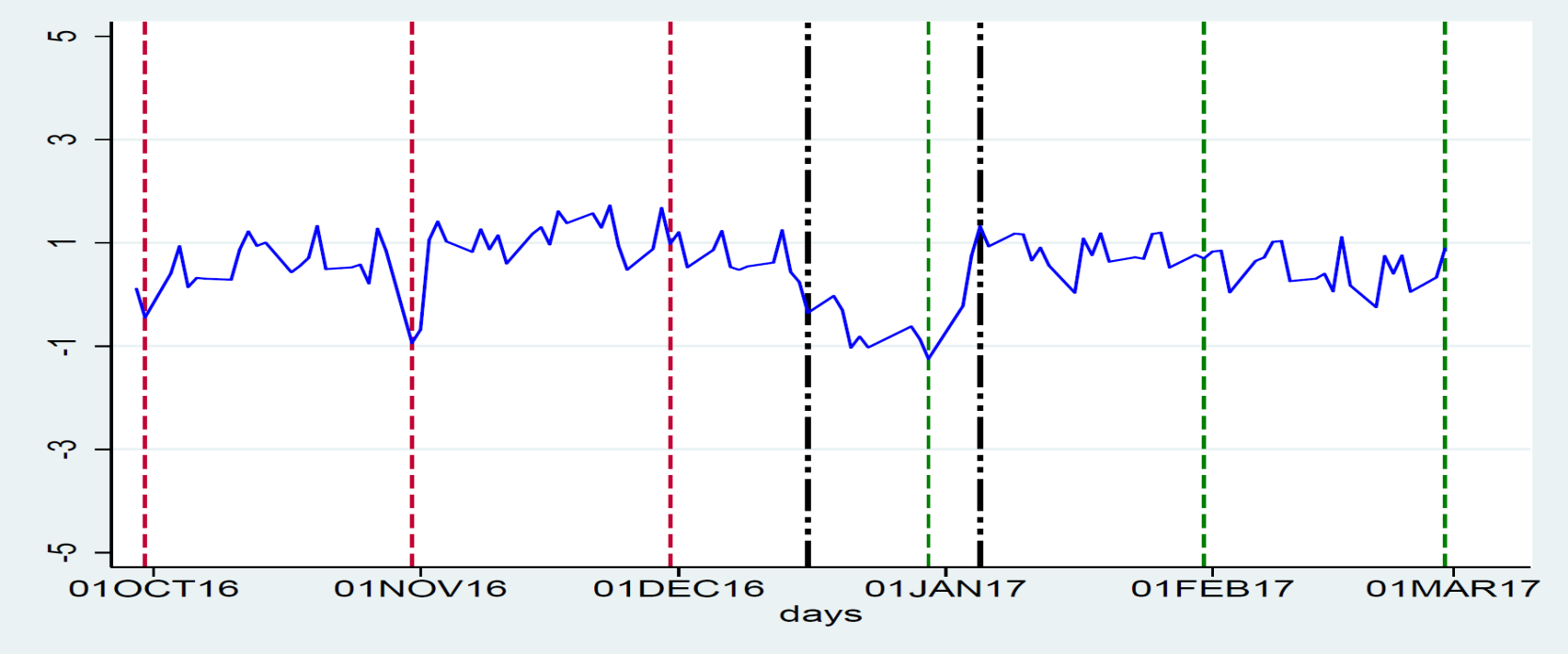
Change in reporting requirement of the LR in the UK

UK affected *vs* EU/US/JP non-affected dealers

Affected dealers reacted to this shock



Non-affected dealers did not



Contribution:
A new shock to evaluate impact of regulatory reforms

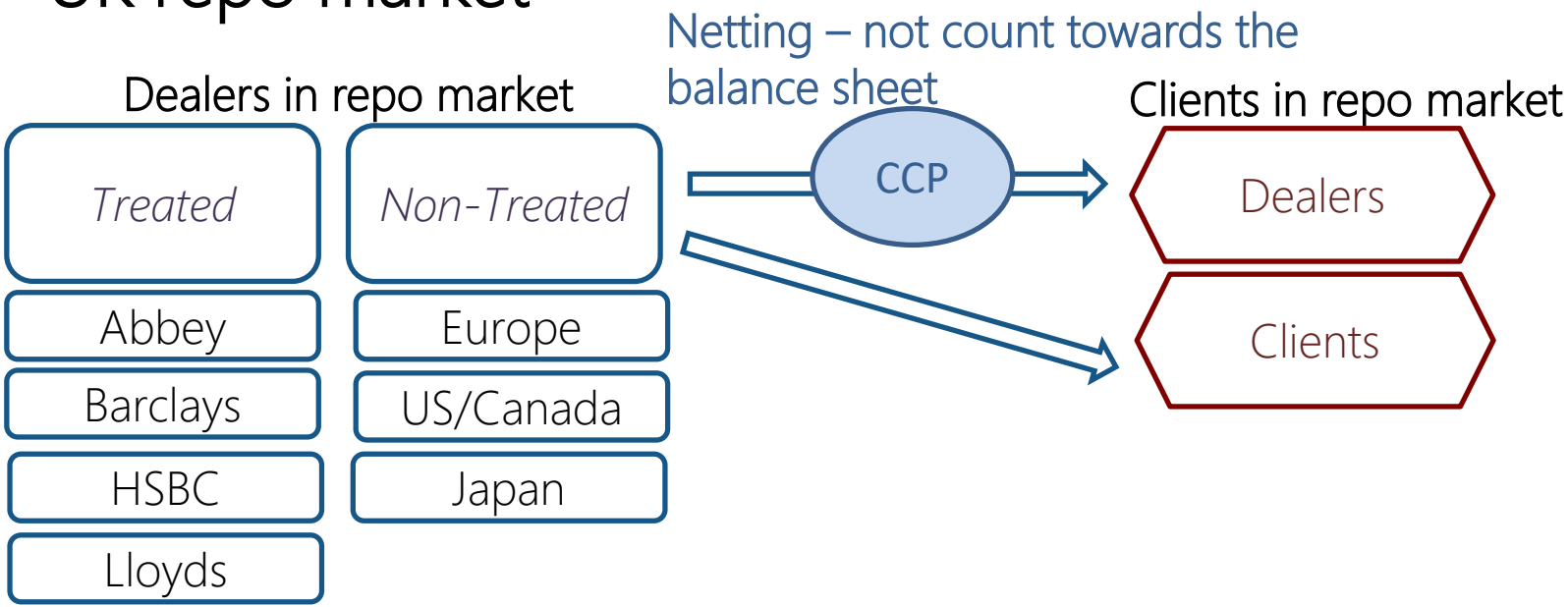
Change in *reporting requirement* of the LR in the UK

Natural treatment and control group

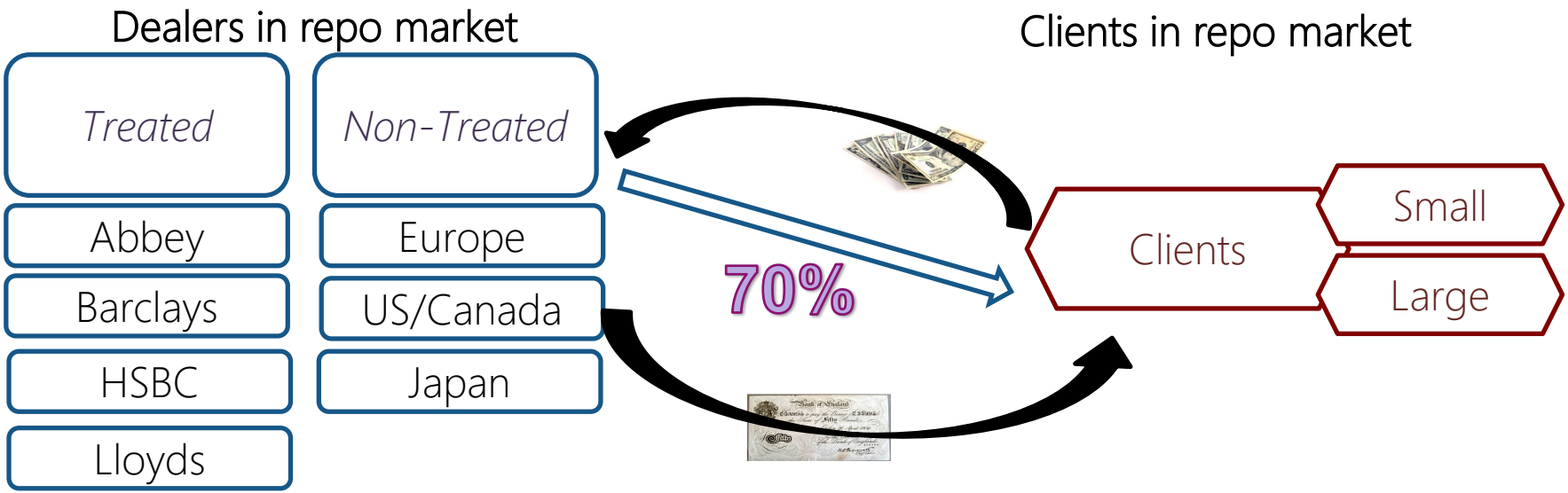
Limited anticipation effects

No other shock at the same time

UK repo market



UK repo market



Ability of clients to invest cash low-risk and access securities

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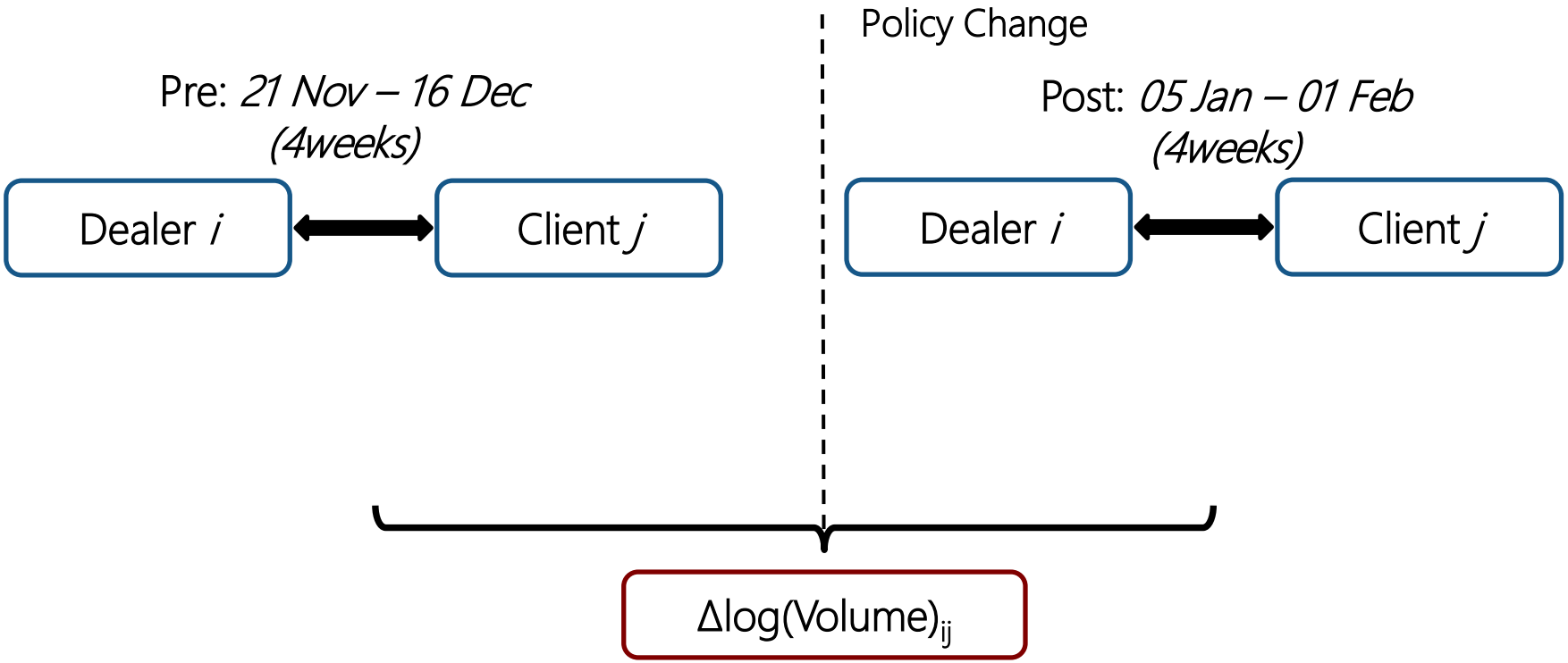
Sterling Money Market Database (SMMD)

- Universe of gilt repo transactions
- From February 2016 onwards; 23 reporting dealers (95% of the market)
- Volume, rate, maturity, collateral etc
- Dealer and client IDs are known
- No reliance on algorithms (Furfine, 1999 – Fedwire & TARGET2)(concerns about quality of algorithm - Armantier and Copeland, 2012)

Sterling Money Market Database (SMMD)

- Cleaning
  - clients: banks and non-banks
  - aggregate legal entities into parent companies
  - only clients with at least 2 dealers (>99% of volume)
- Our sample
  - 15 dealers, 38 clients, 126 dealer-client pairs

Model: *Difference-in-Differences*



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Model: *Difference-in-Differences*

- Aggregate effect
  - $\Delta log(Volume)_{ij} = \beta_1 * Affected_i + \alpha_j + \varepsilon_{ij}$

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    captures <u>changes</u> in repo demand

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captures <u>changes</u> in repo demand

substantially improves identification – Khwaja and Mian, AER 2008

Aggregate effect

	Δlog(Volume)			
	[1]	[2]	[3]	[4]
Affected Dealer	-0.404**	-0.431**	-0.446*	-0.664*
	0.179	0.174	0.231	0.312
Relationship		-0.767	-1.074	-1.705
		0.993	1.056	1.276
Constant	0.137	0.159		
	0.113	0.108		
Client's Sector FE	no	no	yes	no
Client FE	no	no	no	yes
N	126	126	126	126
R^2	0.027	0.031	0.065	0.333

Significance Levels: .01***; .05**; .1*

reduction repo volume

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48.5pp lower repo volume from *same* client

Model: *Difference-in-Differences*

- Heterogeneous effect
  - $\Delta log(Volume)_{ij} = \beta_1 * Affected_i * Cient\ Type_j + \alpha_i + \alpha_j + \varepsilon_{ij}$

  - *small vs large clients (BIS conjecture)*
  - *relationship, foreign, reverse repos, long-term maturities*

Model: *Difference-in-Differences*

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    captures <u>changes</u> in repo demand

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Model: *Difference-in-Differences*

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    captures <u>differences</u> across dealers

  - *small vs large clients (BIS conjecture)*
  - *relationship, foreign, reverse repos, long-term maturities*

Model: *Difference-in-Differences*

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  - $\Delta log(Volume)_{ij} = \beta_1 * Affected_i * Cient\ Type_j + \alpha_i + \alpha_j + \varepsilon_{ij}$

    substantially improve identification

    KM, AER 2008; Jimenez et al, AER 2012

  - *small vs large clients (BIS conjecture)*
  - *relationship, foreign, reverse repos, long-term maturities*

Heterogeneous effect: Small vs Large

	Δlog(Volume)				
	[1]	[2]	[3]	[4]	[5]
Affected Dealer * Small	-0.900***	-0.880***	-0.829*	-1.415**	-1.345***
	0.228	0.228	0.397	0.514	0.433
Affected Dealer	-0.139	-0.159	-0.196	-0.305	
	0.207	0.2	0.233	0.278	
Small	0.490**	0.446*	0.506**		
	0.19	0.204	0.195		
Relationship		-0.487	-0.575	-1.217	-1.101
		1.071	1.091	1.328	1.547
Constant	0.017	0.042			
	0.138	0.133			
Client's Sector FE	no	no	yes	no	no
Client FE	no	no	no	yes	yes
Dealer FE	no	no	no	no	yes
N	126	126	126	126	126
R^2	0.057	0.058	0.089	0.378	0.463

Significance Levels: .01***; .05**; .1*

no effect large clients

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strong effect small clients

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Significance Levels: .01***; .05**; .1*

74pp lower repo volume small relative to large

Heterogeneous effect: Other Types

	Δlog(Volume)							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Affected Dealer * Relationship	1.259*	0.77						
	0.656	0.795						
Affected Dealer * Long-Term Repos			0.408	0.419				
			0.487	0.491				
Affected Dealer * Foreign					-0.483	-0.159		
					0.414	0.41		
Affected Dealer * Reverse Repo							-0.093	-0.300
							0.637	0.616
Affected Dealer * Small		-0.870**		-1.350**		-1.325**		-1.383***
		0.386		0.449		0.45		0.433
Client FE	yes	yes	yes	yes	yes	yes	yes	yes
Dealer FE	yes	yes	yes	yes	yes	yes	yes	yes
N	126	126	126	126	126	126	126	126
R^2	0.459	0.469	0.429	0.468	0.427	0.464	0.425	0.465

Significance Levels: .01***; .05**; .1*

relationship matters…

Heterogeneous effect: Other Types

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Dealer FE	yes	yes	yes	yes	yes	yes	yes	yes
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R^2	0.459	0.469	0.429	0.468	0.427	0.464	0.425	0.465

Significance Levels: .01***; .05**; .1*

…but not as much as size does

Heterogeneous effect: Other Types

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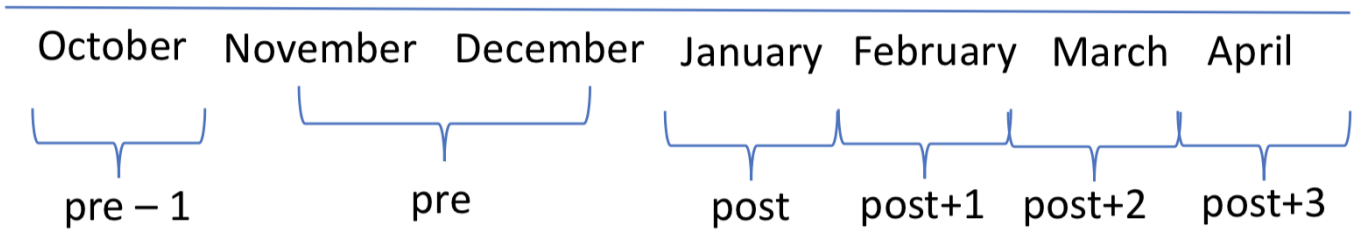
Significance Levels: .01***; .05**; .1*

no differential effect other types

Is this displacement in the market persistent?

- Data sample: October – April



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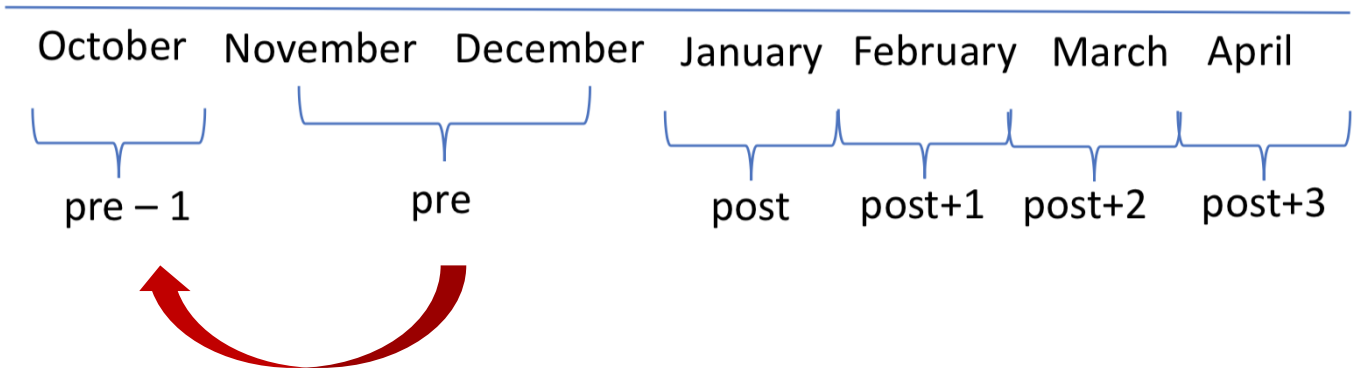

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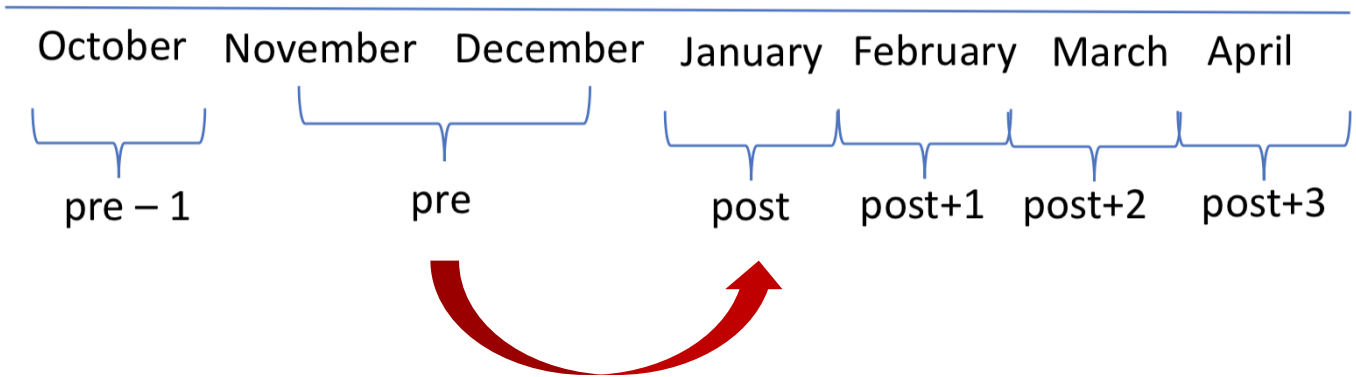

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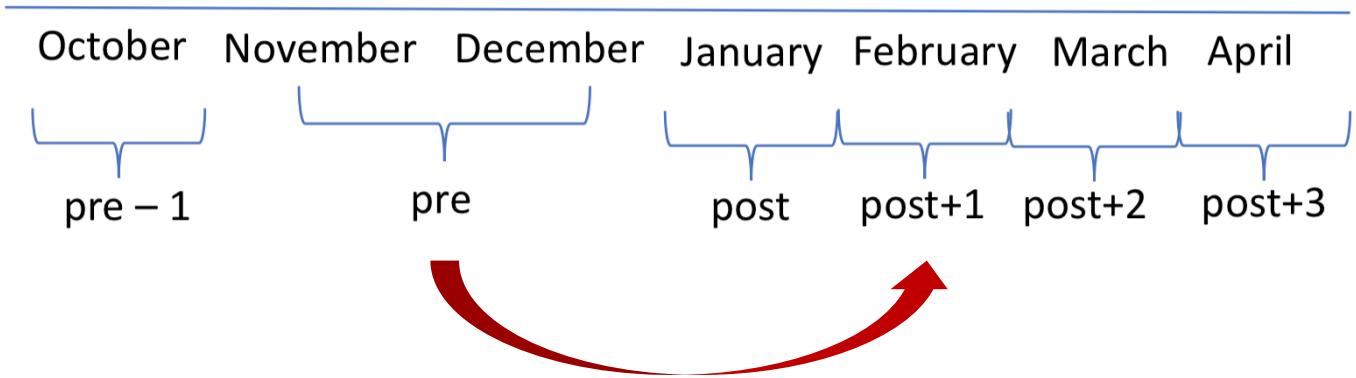

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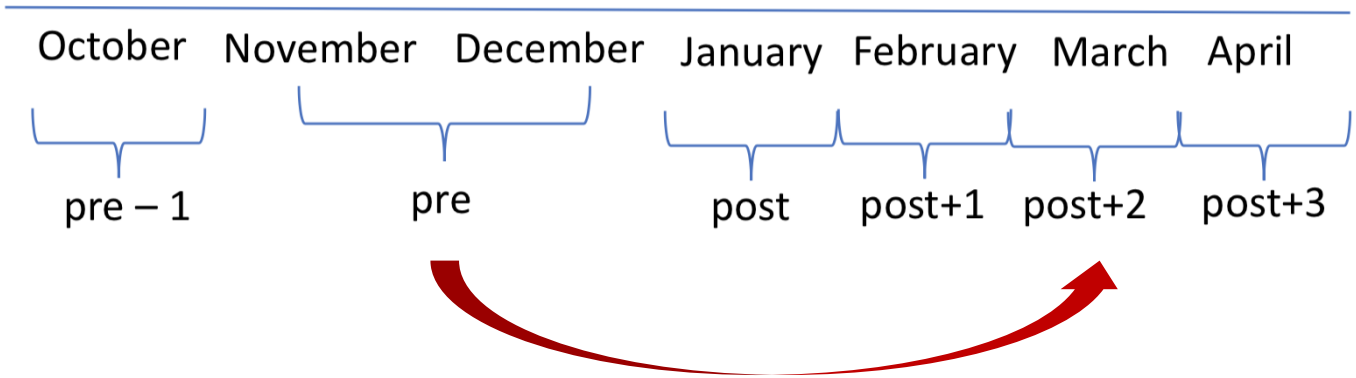

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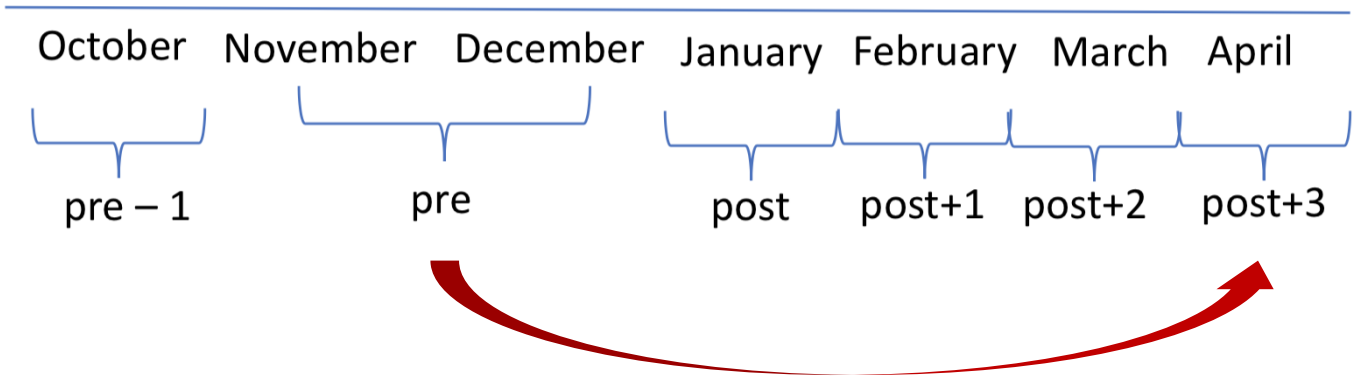
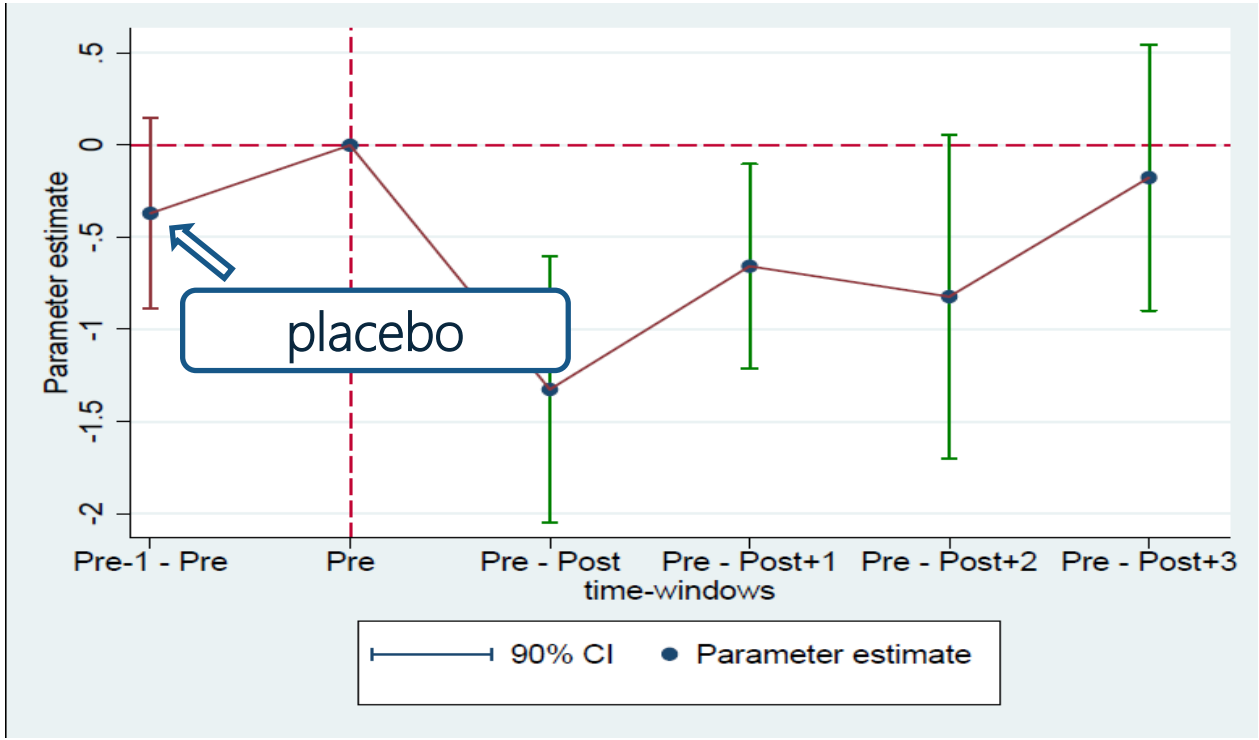


Is this displacement in the market persistent?

- Data sample: October – April

- Remember: *75% of the market overnight*

Persistent effect? (Affected$_i$ * Small$_j$)



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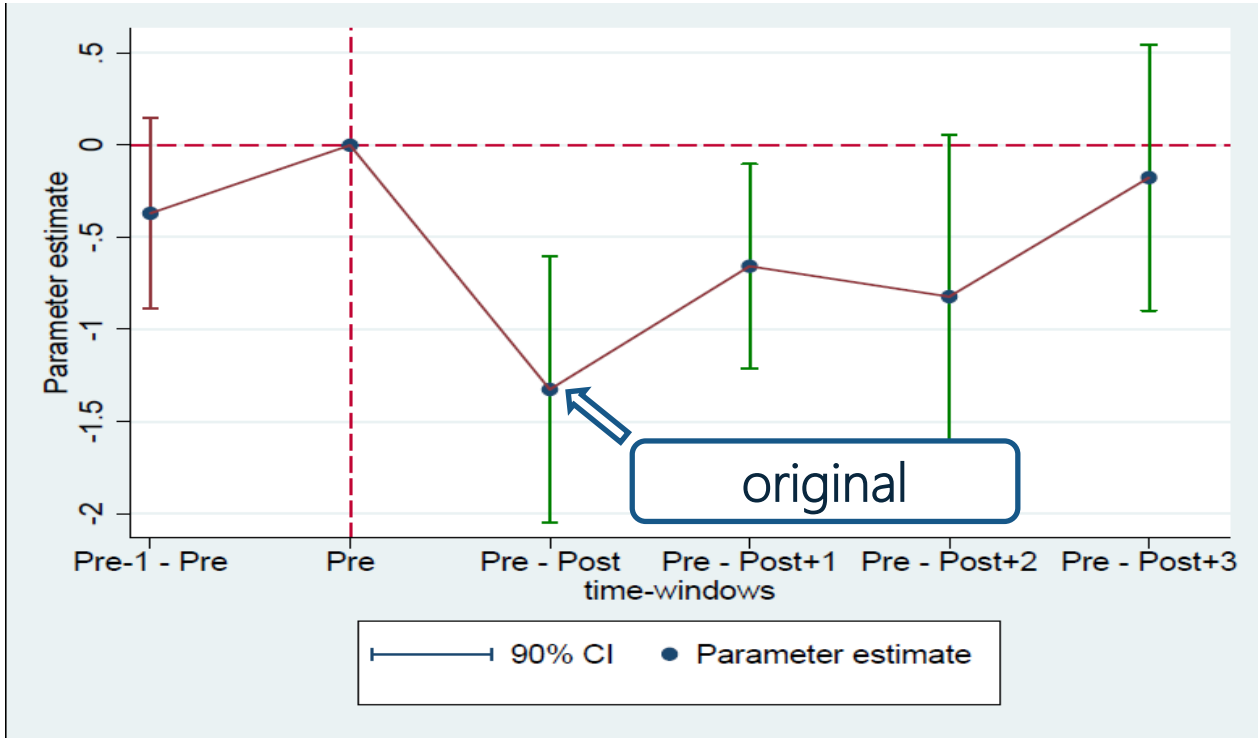

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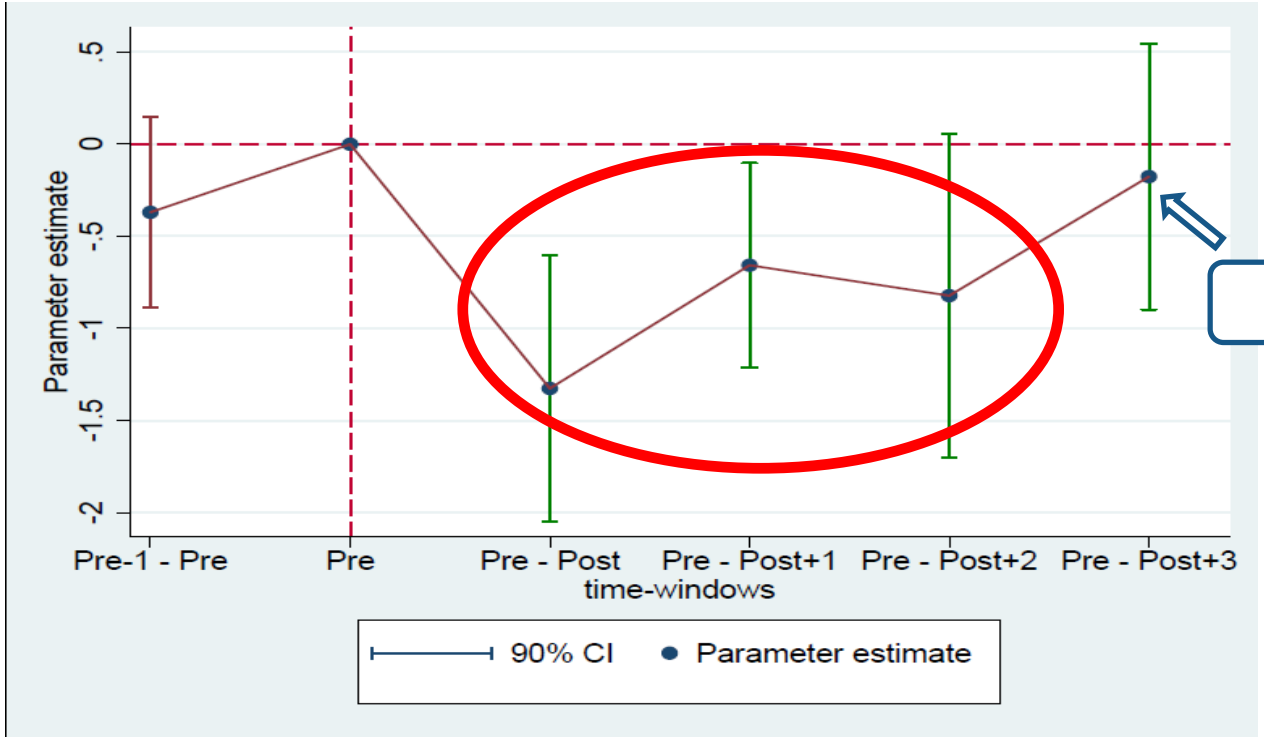

adjustment

Other loan terms

- Frequency of transactions
- Repo rates
- Haircut
- Maturity

Extensive margin and other loan terms

	Extensive Margin		*Repo Loan Terms*					
	Δlog(# Transactions)		ΔRate		ΔHaircut		Δlog(Maturity)	
	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Affected Dealer	-0.388**		-0.006		0.503		0.343	
	0.175		0.026		0.407		0.219	
Affected Dealer * Small		-0.829***		-0.088***		1.168		-0.155
		0.204		0.022		0.86		0.238
Client FE	yes	yes	yes	yes	yes	yes	yes	yes
Dealer FE	no	yes	no	yes	no	yes	no	yes
N	126	126	126	126	126	126	126	126
R^2	0.32	0.475	0.405	0.53	0.409	0.563	0.309	0.452

Significance Levels: .01***; .05**; .1*

lower frequency of transactions

Extensive margin and other loan terms

	Extensive Margin		*Repo Loan Terms*					
	Δlog(# Transactions)		ΔRate		ΔHaircut		Δlog(Maturity)	
	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
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		0.204		0.022		0.86		0.238
Client FE	yes	yes	yes	yes	yes	yes	yes	yes
Dealer FE	no	yes	no	yes	no	yes	no	yes
N	126	126	126	126	126	126	126	126
R^2	0.32	0.475	0.405	0.53	0.409	0.563	0.309	0.452

Significance Levels: .01***; .05**; .1*

small clients higher cost to place cash

Extensive margin and other loan terms

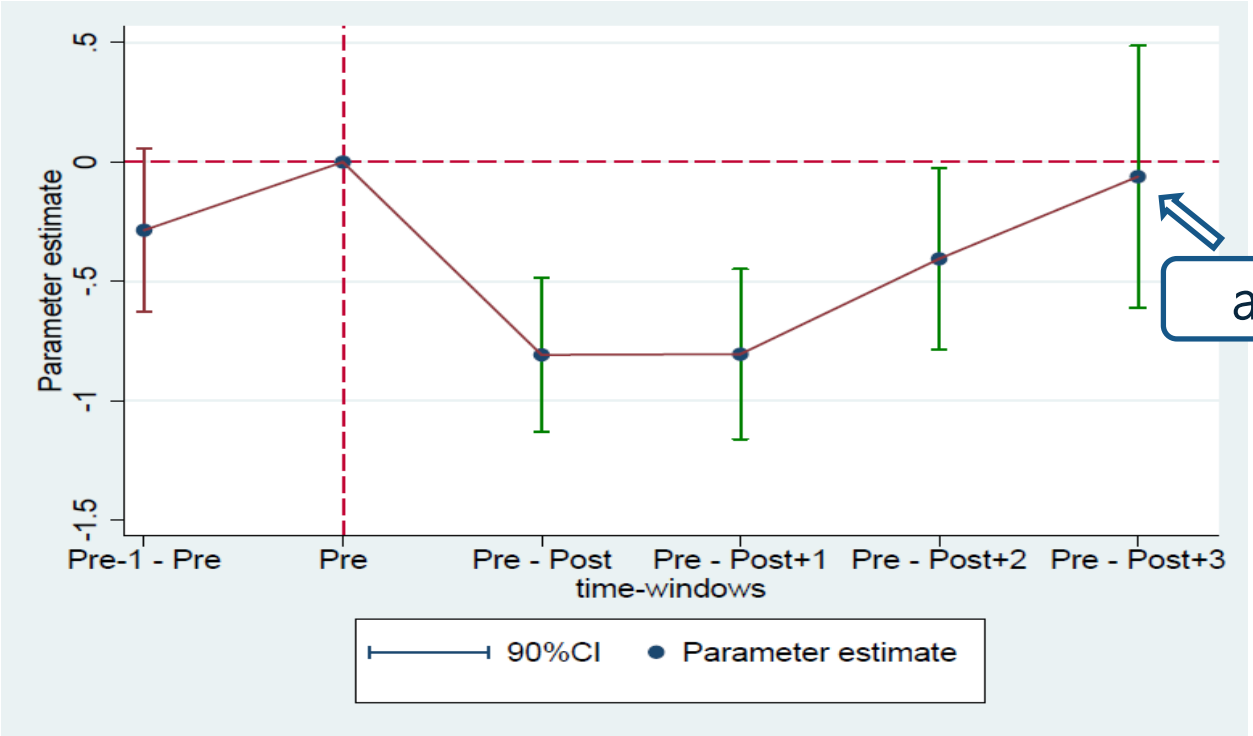
	Extensive Margin		*Repo Loan Terms*					
	Δlog(# Transactions)		ΔRate		ΔHaircut		Δlog(Maturity)	
	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous	Baseline	Heterogeneous
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Affected Dealer	-0.388**		-0.006		0.503		0.343	
	0.175		0.026		0.407		0.219	
Affected Dealer * Small		-0.829***		-0.088***		1.168		-0.155
		0.204		0.022		0.86		0.238
Client FE	yes	yes	yes	yes	yes	yes	yes	yes
Dealer FE	no	yes	no	yes	no	yes	no	yes
N	126	126	126	126	126	126	126	126
R^2	0.32	0.475	0.405	0.53	0.409	0.563	0.309	0.452

Significance Levels: .01***; .05**; .1*

no effect haircut and maturities

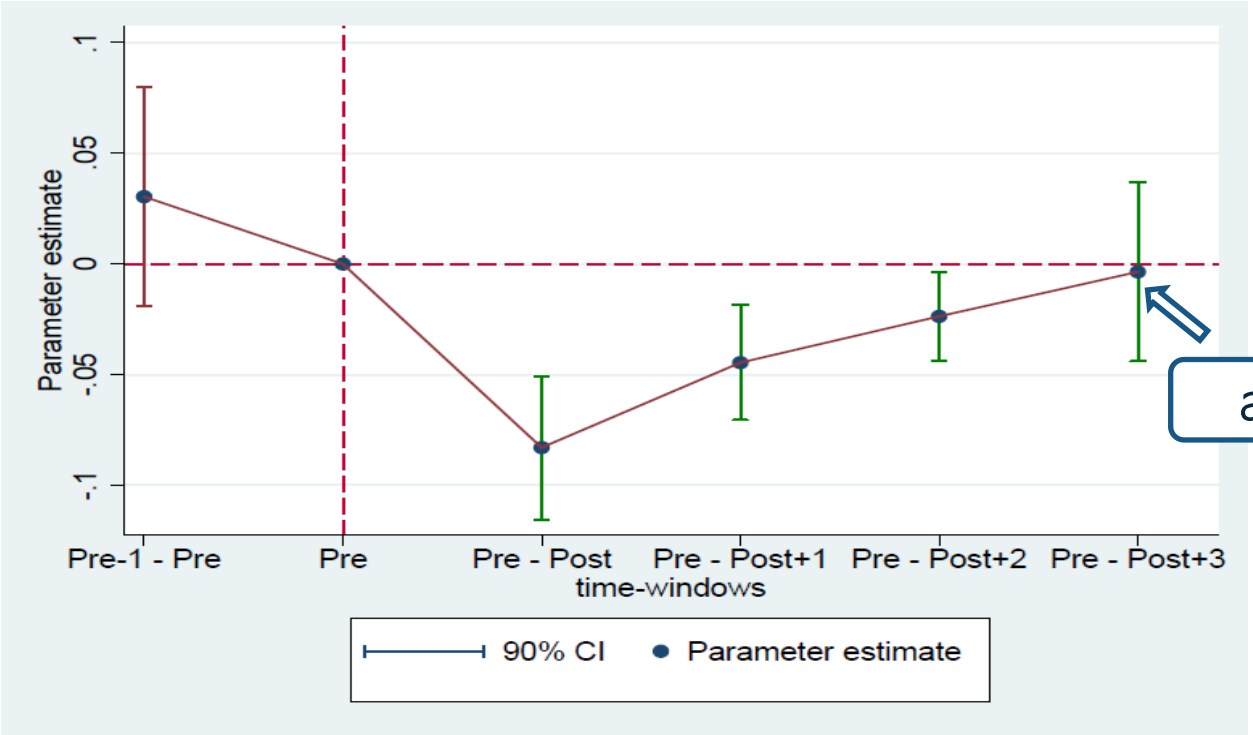
Persistent effect in Frequency of Transactions?

(Affected$_i$ * Small$_j$)



adjustment

Persistent effect in Rates? (Affected$_i$ * Small$_j$)



Robustness Checks

- Reverse Repos as a falsification test
- alternative definitions of small client
- alternative time-windows
- Weighted Least Squares, alternative winsorizing, wild cluster bootstrapping (Cameron, Gelbach and Miller, 2009)

Market adjustment

- Substitution model
  - $\Delta log(Aggr.\ Volume)_j = \beta_1 * Highly\ Exposed_j + \beta_1 * Highly\ Exposed_j * Small_j + \beta_1 * Small_j + \hat{a}_j + \varepsilon_j$

$Highly\ Exposed_j$ is client with above median share of repos intermediated by affected dealers

Market adjustment

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  - $\Delta log(Aggr.\ Volume)_j = \beta_1 * Highly\ Exposed_j + \beta_1 * Highly\ Exposed_j * Small_j + \beta_1 * Small_j + \hat{a}_j + \varepsilon_j$

    (Abowd, Kramarz and Margolis, ECMA 1999; Cingano, Manaresi and Sette, RFS 2016)

$Highly\ Exposed_j$ is client with above median share of repos intermediated by affected dealers

$\hat{a}_j$ isolates <u>foreign</u> dealers' repo supply from clients' repo demand

Market adjustment

	Δlog(AggrVolume)		New Repo Relationship	
	Baseline	Heterogeneous	Baseline	Heterogeneous
	[1]	[2]	[3]	[4]
Highly Exposed	-0.390	-0.136	-0.007	-0.093
	[0.273]	[0.889]	[0.971]	[0.452]
Highly Exposed * Small		-0.584*		0.165
		[0.088]		[0.3]
Small		-0.084		0.186
		[0.714]		[0.354]
Constant	0.285	0.371**	0.419	0.326
	[0.388]	[0.047]	[0.159]	[0.471]
Client Demand	yes	yes	yes	yes
N	38	38	38	38

lower magnitude – foreign dealers step in

Market adjustment

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particularly for small clients

Market adjustment

	Δlog(AggrVolume)		New Repo Relationship	
	Baseline	Heterogeneous	Baseline	Heterogeneous
	[1]	[2]	[3]	[4]
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based on pre-existing (not new) relationships

Market adjustment

- Small clients able to (partially) substitute repo losses
- Importance of existing relationships with foreign dealers
- Foreign dealers increased small clients market share (39 to 49%)

Policy Implications

- We show that dynamics in repo market are shaped by the leverage ratio – LR disincentivizes low-risk activities

- Current debate:
  - LR promotes stability
  - What about efficiency? (Quarles, 2018)
  - Proposal to recalibrate eSLR (OCC & Fed Board, 2018)

Thank You!