Currency Mispricing and Dealer Balance Sheets

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ABFER 7^{th} Annual Conference, Singapore

May 27-30, 2019

The views expressed here are those of the authors and not necessarily those of the Bank of England.

Introduction

- Excessive leverage was among the causes of the global financial crisis
  - ✓ As a backstop, the Basel Committee proposed a naïve leverage ratio, related to the size (not the composition) of a bank's balance sheet.

$$\text{Leverage Ratio} = \frac{\text{Capital Measure}}{\text{Exposure Measure}} \geq \text{Min Requirement}$$

  - ✓ Market participants argue that the leverage ratio has increased the costs of intermediation, especially for balance-sheet intensive business.

"[A]t the end of the day the Basel Committee has put aside some three decades of oversight based on risk-weighted assets in favour of a blunt measure of total leverage - with all kinds of unintended consequences the likely result."

Reuters, 5 August 2013

Motivation: An Illustrative Example

- Suppose a bank has a target return on equity of 10%
  - ✓ the minimum leverage ratio requirement is 3%,
  - ✓ at least 3% of capital against assets in its balance sheet.

- Using a simple back-of-the-envelope calculation

$$\begin{aligned} \text{Return on Assets} &= \frac{\text{Profit}}{\text{Equity}} \times \frac{\text{Equity}}{\text{Assets}} \\ &= \text{Return on Equity} \times \text{Leverage Ratio} \\ &= 10\% \times 3\% = 30 \ \textit{bps} \end{aligned}$$

- At least 30 *bps* of **Return on Assets** to engage a bank in a trade.

Motivation

- A **negative basis** between onshore and offshore dollar funding rates

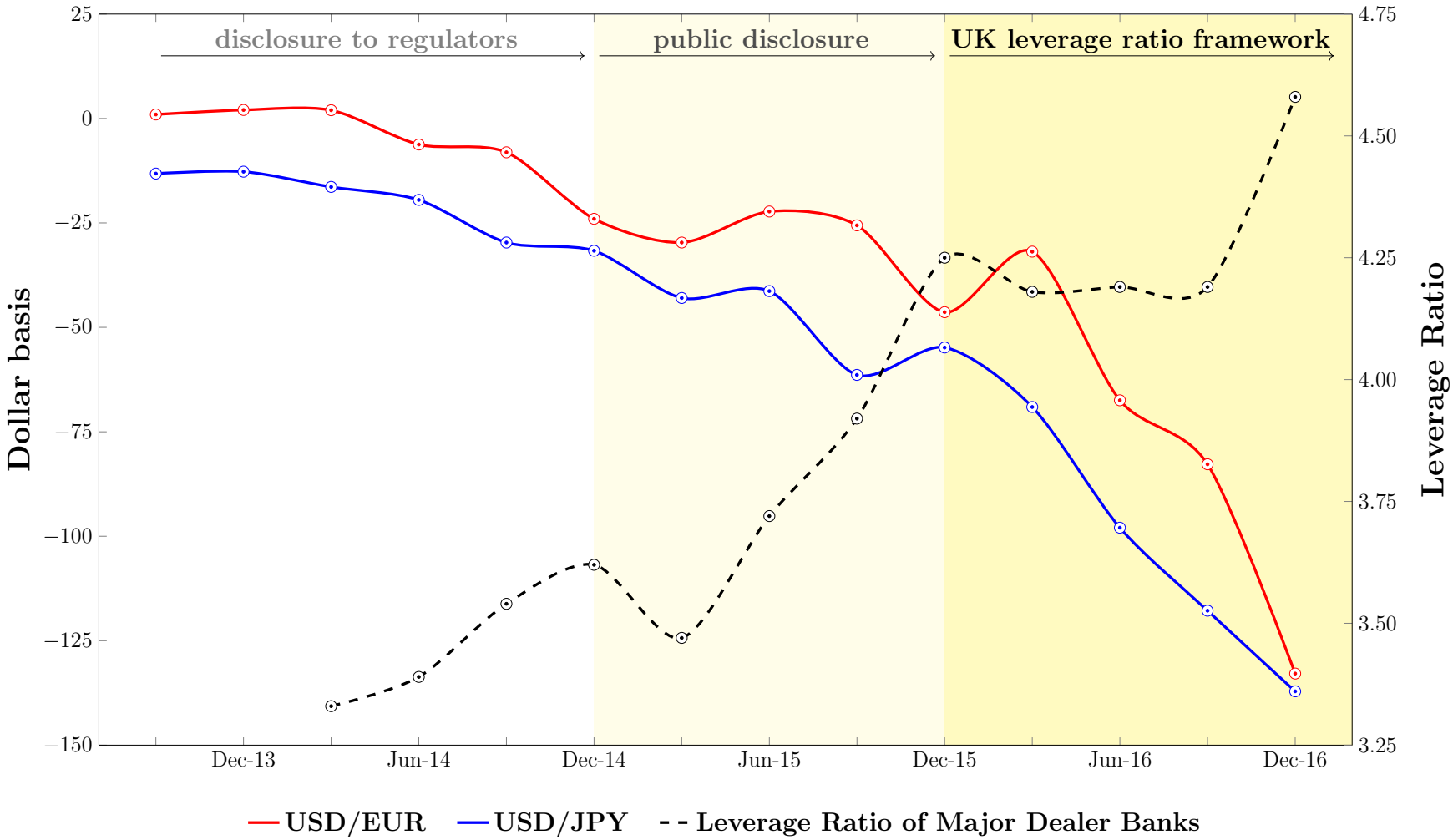
$$\underbrace{i_t}_{\text{cash rate}} - \underbrace{[f_t - s_t + i_t^\star]}_{\text{synthetic rate}} < 0$$

  - ✓ Borrowing dollars through FX swaps more expensive than in the US cash market due to persistently large CIP violations since 2014,
  - ✓ Balance-sheet constraints at quarter-ends (Du et al., 2018), hedging pressure (Borio et al., 2016), and transaction costs (Rime et al., 2017).

- The empirical identification remains challenging with aggregate data
  - ✓ We need to isolate supply factors from demand factors, and the leverage ratio may be correlated with (unobserved) banks' characteristics,
  - ✓ As noted by He & Krishnamurthy (2018), we should quantify how a percentage change in capital impacts the supply of forwards.

Dollar Basis and Leverage Ratio

Back-of-the-envelope calculation: up to $92 billions per year of extra borrowing costs



- The **basis** is computed as deviation from **covered interest parity** (CIP) condition.

Summary of the Paper

- What we do ...
  - ✓ Use a **unique dataset** on FX swaps and forwards with counterparties' and contracts' details from Dec 2014 to Dec 2016,
  - ✓ Study the relation between dealer banks' **leverage ratio** and the **dollar basis** at the **dealer level** for six major currency pairs.
- What we find ...
  - ✓ The **dollar basis widens** and the volume falls when the **leverage ratio** increases, controlling for changes in demand conditions at the sector or client level (e.g., Khwja & Mian, 2008),
  - ✓ We exploit the introduction of the **UK leverage ratio** framework in Jan 2016 and the **public disclosure** requirement in Jan 2015.

Our main contribution ...

- ✓ A σ increase in the leverage ratio raises the dollar funding cost up to 28 *bps* per annum, i.e., up to $92 billion of extra borrowing costs.

Literature Review

- **Studies until the collapse of Lehman Brothers ...**
  - ✓ A vast literature finds that CIP holds (e.g., Frankel & Levich, 1975, 1977; Clinton, 1988; Taylor, 1989; Akram, Rime & Sarno, 2008).
- **... during the global financial crisis ...**
  - ✓ Large basis due to credit/liquidity risk (e.g., Baba & Packer, 2009; Coffey, Hrung & Sarkar, 2009; Mancini-Griffoli & Ranaldo 2011),
  - ✓ Swap lines Fed/Central Banks to mitigate tensions in US cash markets.
- **... and recently since 2014**
  - ✓ Monetary policy divergence and more FX hedging (Borio *et al.*, 2016),
  - ✓ Tighter balance sheet constraints at quarter-ends associated with FX arbitrage opportunities (Du, Tepper & Verdelhan, 2018),
  - ✓ Only large banks can exploit arbitrage opportunities as transaction costs are large in the cash markets (Rime, Schrimpf & Syrstad, 2016).

Trade Repository Data

A description

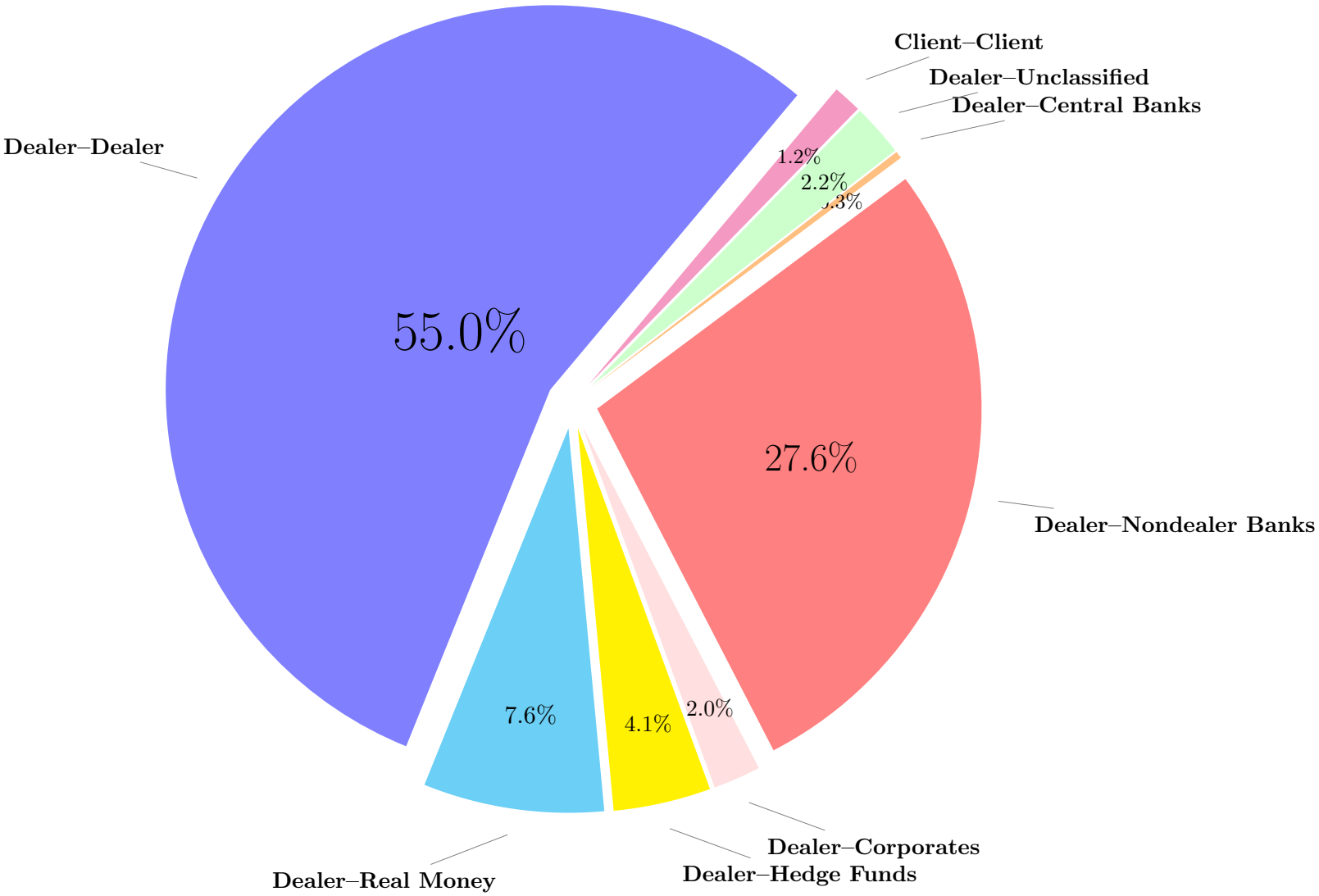
- European Market Infrastructure Regulation (**EMIR**)
  - ✓ Since 2014, it is mandatory for EU legal entities to report their transactions to trade repositories (e.g., Abad *et al.*, 2016),
  - ✓ Data available to **supervisory authorities**.
- We mainly focus on **FX swaps and forwards**
  - ✓ Counterparties' information (i.e., legal entity and corporate sector) and contract characteristics (e.g., price and notional amount),
  - ✓ Data on 6 dollar currency pairs from Dec-2014 to Dec-2016 from DTCC, more than 40% of their global trading activity.
- We manually classify more than 30,000 individual counterparties
  - ✓ 17.2 million transactions involving both dealers and clients.

Trade Repository Data

Classification of individual counterparties

- Interdealer Segment
  - ✓ A list of 17 dealers based on Euromoney FX survey: Bank of America Merrill Lynch, Barclays, BNP Paribas, Citi, Crédit Agricole, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Morgan Stanley, Nomura, Royal Bank of Scotland, Société Générale, Standard Chartered, State Street and UBS,
  - ✓ We consolidate up to 106 different legal entities in the FX forward market.
- Client Segment
  - ✓ Real money investors (i.e., asset managers, pension funds, insurance firms, state institutions), hedge funds, corporates, non-dealer banks (i.e., commercial banks, small dealers, prime brokerage firms), central banks, and unclassified clients (i.e., missing/incorrect LEI).

Market Share by Sector



▸ Currency ▸ Maturity ▸ Overall

Transaction-level Dollar Basis

- We construct contract-level CIP deviations as

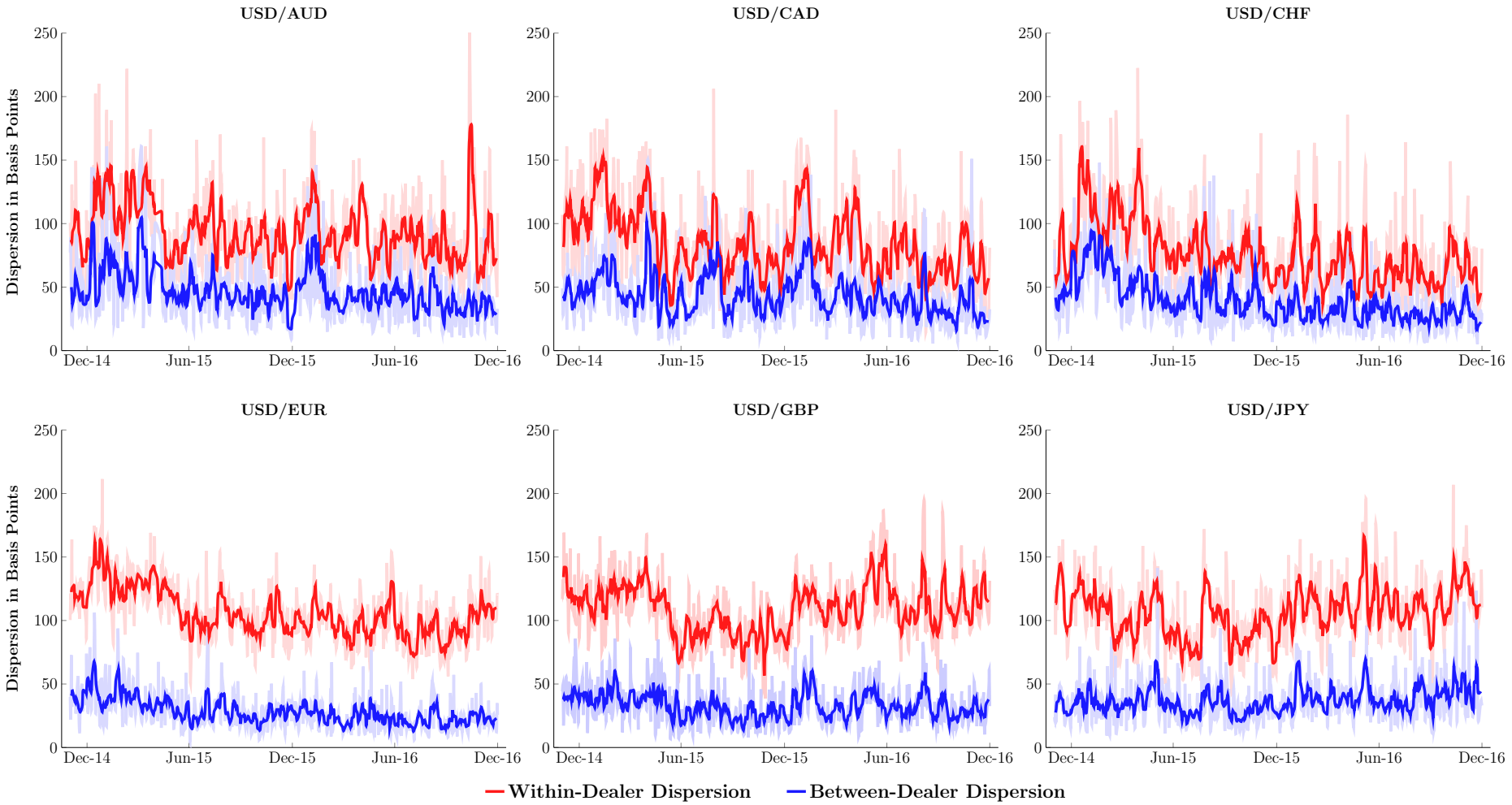
$$B_{ij\kappa\ell,t} = (1 + r_{\ell,t}) - (1 + r_{i\ell,t}) \frac{F_{ij\kappa\ell,t}}{S_{i,t}}$$

  - ✓ $r_{\ell,t}$ and $r_{i\ell,t} \rightarrow$ dollar and foreign interest rate, respectively,
  - ✓ $S_{i,t}$ and $F_{ij\kappa\ell,t} \rightarrow$ spot and forward exchange rate, respectively,
  - ✓ $i \rightarrow$ currency, $j \rightarrow$ dealer, $\kappa \rightarrow$ counterparty, and $\ell \rightarrow$ maturity.

- We synchronize our contract-level forwards with
  - ✓ Second-level spot and OIS rates from Thomson Reuters Tick History,
  - ✓ Linearly interpolated OIS rates for nonstandard maturities,
  - ✓ CIP deviations related to shifts in the demand/supply of forward contracts (e.g., Borio *et al.*, 2016).

▸ Descriptive Statistics

Dollar Basis: Decomposition of the Dispersion



Dollar Basis and Leverage Ratio

Controlling for Currency and Sector Characteristics

- We first run the following specification

$$A_{ij\kappa\ell,t} = \beta_1 L_{j,t-1} + \beta_2 C_{j,t-1} + \gamma' X_{j,t-1} + FE + \varepsilon_{ij\kappa\ell,t},$$

  - ✓ $A_{ij\kappa\ell,t} \rightarrow$ all contract-level dollar basis on day t in absolute value,
  - ✓ $L_{j,t} \rightarrow$ quarter-end leverage ratio (forward-filling for higher-frequency),
  - ✓ $C_{j,t} \rightarrow$ quarter-end capital ratio (forward-filling for higher-frequency),
  - ✓ $X_{j,t} \rightarrow$ dealer-specific variables (forward-filling for higher-frequency),
  - ✓ $FE \rightarrow$ fixed effects that control for time-variant & time-invariant unobserved characteristics.

- The basis widens up to 28 *bps* per annum for a σ increase in L_j
  - ✓ time-variant/invariant unobserved currency and sector-related factors.

Dollar Basis and Leverage Ratio

Controlling for Currency and Sector Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage Ratio	19.110***	20.457***	20.193***				17.445***	19.391***	18.949***
	(3.885)	(3.480)	(3.176)				(4.306)	(3.415)	(3.145)
Capital Ratio				3.797**	3.374**	3.487***	1.334	0.860	1.030
				(1.489)	(1.535)	(1.229)	(1.711)	(1.562)	(1.234)
Bank Size		38.126**	39.660*		18.062	20.680		37.938**	39.055*
		(15.577)	(21.455)		(19.349)	(23.617)		(14.956)	(20.558)
Liquid Asset Share		−1.123***	−1.377***		−1.347***	−1.585***		−1.099***	−1.352***
		(0.359)	(0.322)		(0.380)	(0.368)		(0.353)	(0.324)
Deposit Share		0.281	0.334**		0.178	0.229		0.282	0.336**
		(0.185)	(0.150)		(0.182)	(0.152)		(0.186)	(0.152)
Δ *Bank CDS*		−0.178	−0.053		−0.216	−0.089		−0.181	−0.056
		(0.216)	(0.167)		(0.218)	(0.168)		(0.213)	(0.165)
Δ *Bank IVOL*		−0.223	−0.209		−0.284	−0.264		−0.224	−0.209
		(0.179)	(0.150)		(0.182)	(0.157)		(0.179)	(0.151)
R^2	0.136	0.137	0.183	0.135	0.136	0.182	0.136	0.137	0.183
Obs	3,474,102	3,474,102	3,473,604	3,474,102	3,474,102	3,473,604	3,474,102	3,474,102	3,473,604
Dealer/Maturity/Hour	Y	Y	Y	Y	Y	Y	Y	Y	Y
Currency	Y	Y	N	Y	Y	N	Y	Y	N
Sector×Time	Y	Y	N	Y	Y	N	Y	Y	N
Currency×Sector×Time	N	N	Y	N	N	Y	N	N	Y

Standard errors clustered by time and currency dimension

Dollar Basis (Volume) and Leverage Ratio

Controlling for Currency and Client Characteristics

- We control for client-specific changes in demand,
  - ✓ Introduce client-time fixed effects akin to Khwaja & Mian (2008),
  - ✓ Work with volume-weighted weekly data in order to have clients with multiple trading relationships,
  - ✓ Check whether the same client dealing with multiple dealers faces a wider basis from dealers with a relatively higher leverage ratio.

- Hence, we run the following specification

$$A_{ij\kappa,t} = \beta_1 L_{j,t-1} + \beta_2 C_{j,t-1} + \gamma' X_{j,t-1} + FE + \varepsilon_{ij\kappa\ell,t},$$

  - ✓ $A_{ij\kappa,t} \rightarrow$ volume-weighted absolute dollar basis for week t,
  - ✓ $A_{ij\kappa,t}$ widens up to 23 *bps* per annum for a σ increase in L_j,
  - ✓ We also replace $A_{ij\kappa,t}$ with the percentage log-volume $lnV_{ij\kappa,t} \times 100$

Dollar Basis and the Leverage Ratio

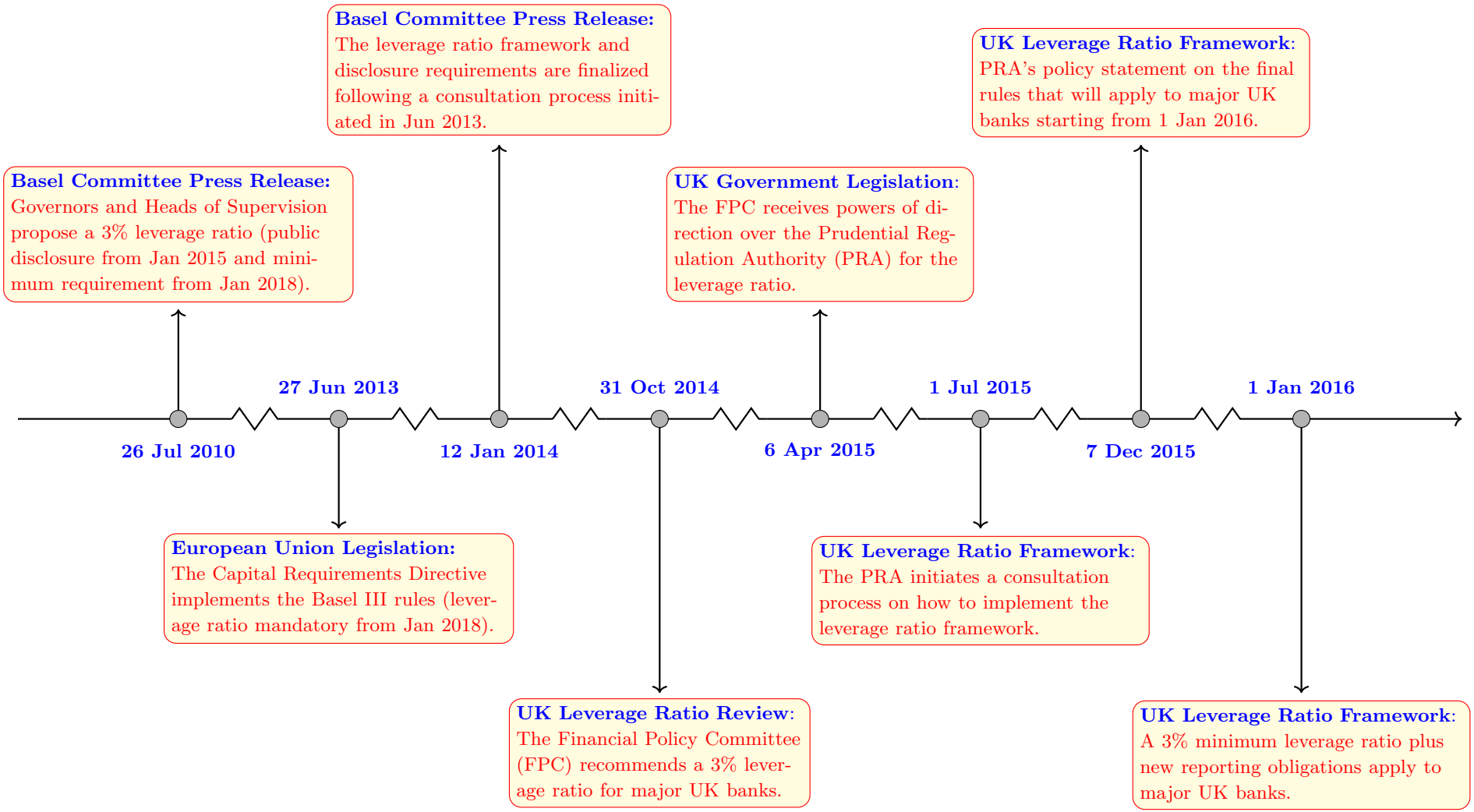
Controlling for Currency and Client Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage Ratio	15.992***	16.198***	16.911***				12.177***	12.698***	12.713***
	(4.362)	(4.329)	(3.985)				(3.811)	(3.647)	(3.330)
Capital Ratio				5.269***	4.941***	5.655***	3.733***	3.410***	4.135***
				(1.473)	(1.499)	(1.535)	(1.276)	(1.256)	(1.355)
Bank Size		17.208*	21.123**		6.369	11.111		16.616*	20.386**
		(9.446)	(8.944)		(10.036)	(9.598)		(8.632)	(7.899)
Liquid Asset Share		−1.105***	−0.909***		−1.222***	−0.991***		−1.051**	−0.845*
		(0.390)	(0.331)		(0.432)	(0.365)		(0.391)	(0.330)
Deposit Share		0.234	0.377		0.106	0.253		0.216	0.356
		(0.167)	(0.234)		(0.170)	(0.245)		(0.165)	(0.235)
Δ *Bank CDS*		−0.052	0.006		−0.095	−0.040		−0.071	−0.018
		(0.183)	(0.148)		(0.184)	(0.145)		(0.178)	(0.154)
Δ *Bank IVOL*		−0.040	−0.341		−0.071	−0.355		−0.018	−0.311
		(0.322)	(0.352)		(0.322)	(0.354)		(0.321)	(0.351)
R^2	0.566	0.566	0.603	0.566	0.566	0.603	0.566	0.566	0.603
Obs	749,895	749,895	344,473	749,895	749,895	344,473	749,895	749,895	344,473
Dealer	Y	Y	Y	Y	Y	Y	Y	Y	Y
Currency	Y	Y	N	Y	Y	N	Y	Y	N
Client × Time	Y	Y	N	Y	Y	N	Y	Y	N
Currency × Client × Time	N	N	Y	N	N	Y	N	N	Y

Standard errors clustered by time and currency dimension

▸ Leverage Ratio and Volume

Leverage Ratio Timeline



The UK Leverage Ratio Framework

Difference-in-differences regressions: before and after 1 January 2016

- We run the following difference-in-differences regressions:

$$A_{ij\kappa,t} = \beta D_p + \delta D_a + \gamma (D_p \times D_a) + FE + \varepsilon_{ij\kappa,t},$$

  - ✓ $D_{post} \rightarrow$ dummy variable for the post-regulatory period,
  - ✓ $D_{affected} \rightarrow$ dummy variable for treated dealer banks.

- Only major UK banks are subject to this framework
  - ✓ UK banks required to measure their leverage ratio on the last day of each month and then take the average over the quarter since Jan 2016,
  - ✓ Pre- (2 Nov/18 Dec 2015) and post-regulatory period (11 Jan/26 Feb 2016) with year-end period excluded (e.g., window dressing effects),
  - ✓ Use dollar basis between 1-week and 1-month, i.e., there is no cross-over between pre- and post-regulatory period.

The UK Leverage Ratio Framework

Difference-in-differences regressions: before and after 1 January 2016

	(1)	(2)	(3)	(4)
Affected Dealers × *Post Regulatory Date*	24.115***	23.787**		
	(6.207)	(9.084)		
Affected Dealers × *Post Placebo Date*			−28.010*	−19.957
			(14.924)	(14.305)
R^2	0.658	0.634	0.661	0.656
Obs	42,825	22,096	42,680	21,226
Dealer	Y	Y	Y	Y
Currency	Y	N	Y	N
Client×Time	Y	N	Y	N
Currency×Client×Time	N	Y	N	Y

Clustered standard errors (currency dimension)

▸ Public Disclosure ▸ MMF Reform ▸ Monetary Policy Shocks ▸ Order Flow ▸ XCCY

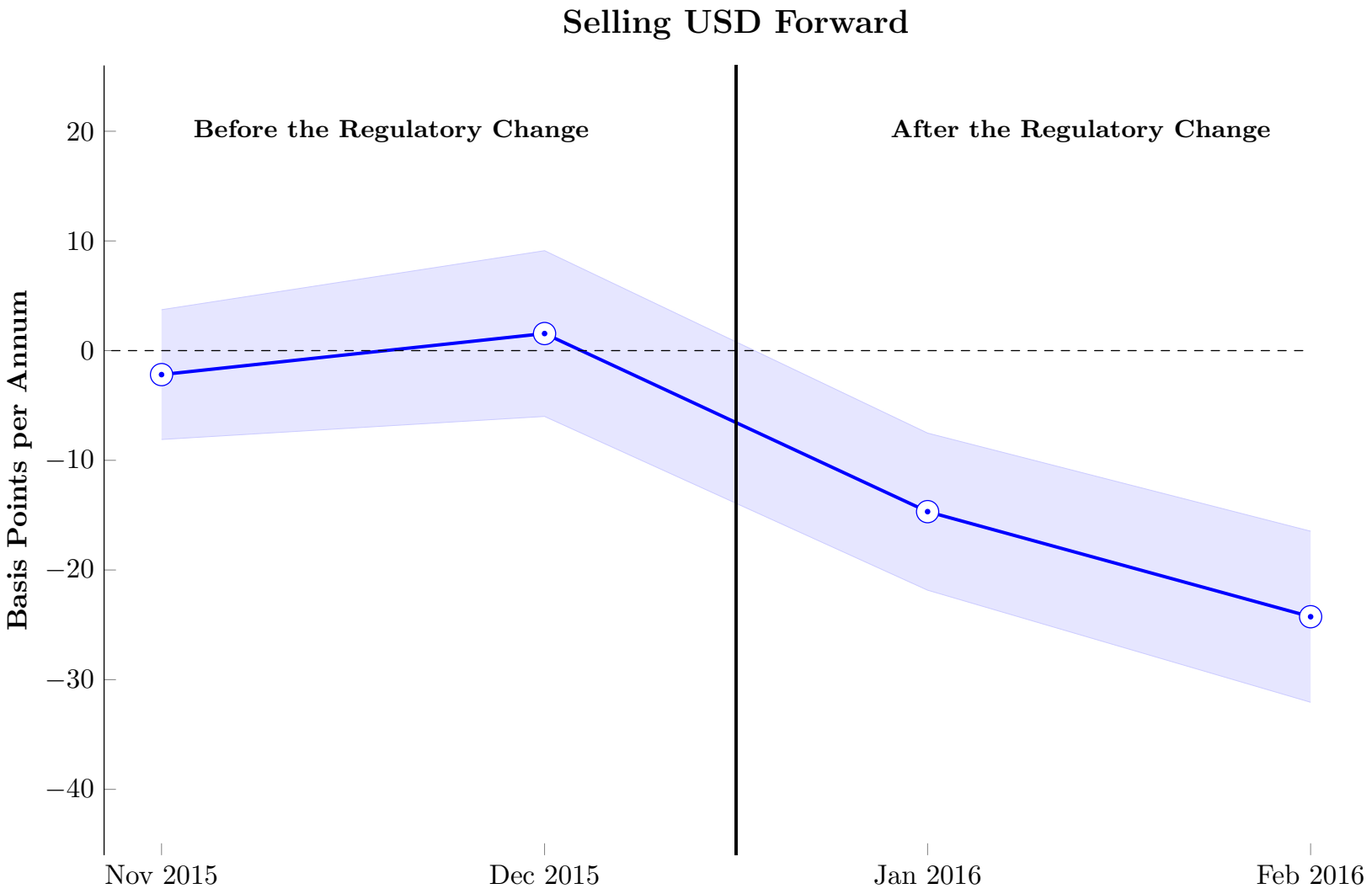
The UK Leverage Ratio Framework

Difference-in-differences regressions: Conditioning on trade direction

	Selling USD Forward		Buying USD Forward	
	(1)	(2)	(3)	(4)
Affected Dealers × *Post Regulatory Date*	−21.706***	−18.745***	2.704	3.040
	(5.316)	(5.477)	(5.668)	(5.906)
Δ *Dealer CDS*		−0.533***		−0.334*
		(0.158)		(0.184)
Δ *Dealer IVOL*		−1.300***		−1.434***
		(0.318)		(0.389)
R^2	0.523	0.523	0.485	0.485
Obs	8,842	8,842	8,875	8,875
Dealer	Y	Y	Y	Y
Currency × *Client* × *Time*	Y	Y	Y	Y

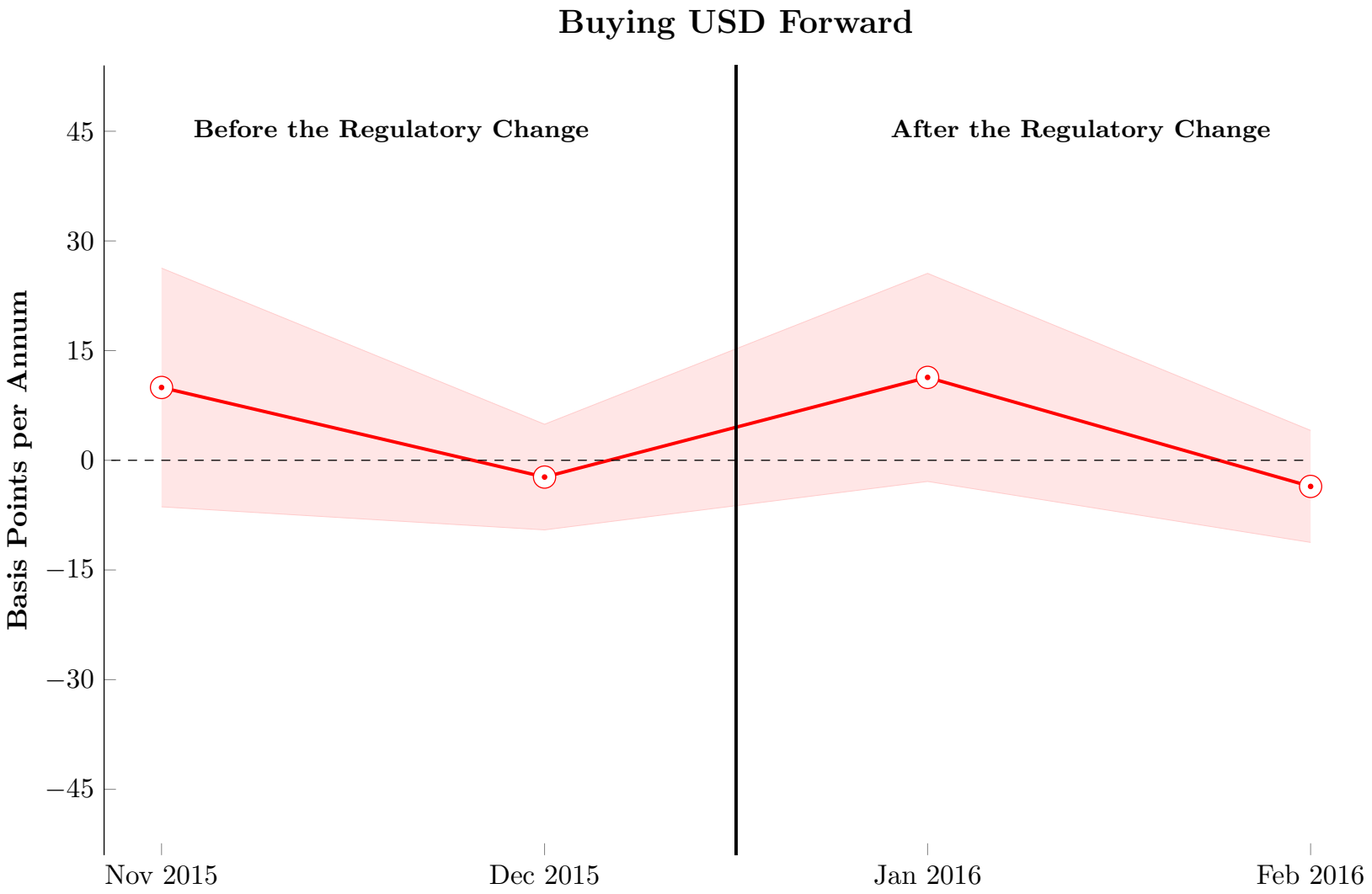
The UK Leverage Ratio Framework

Spread between **treated** (UK banks) and **untreated** (subsidiaries of foreign banks)

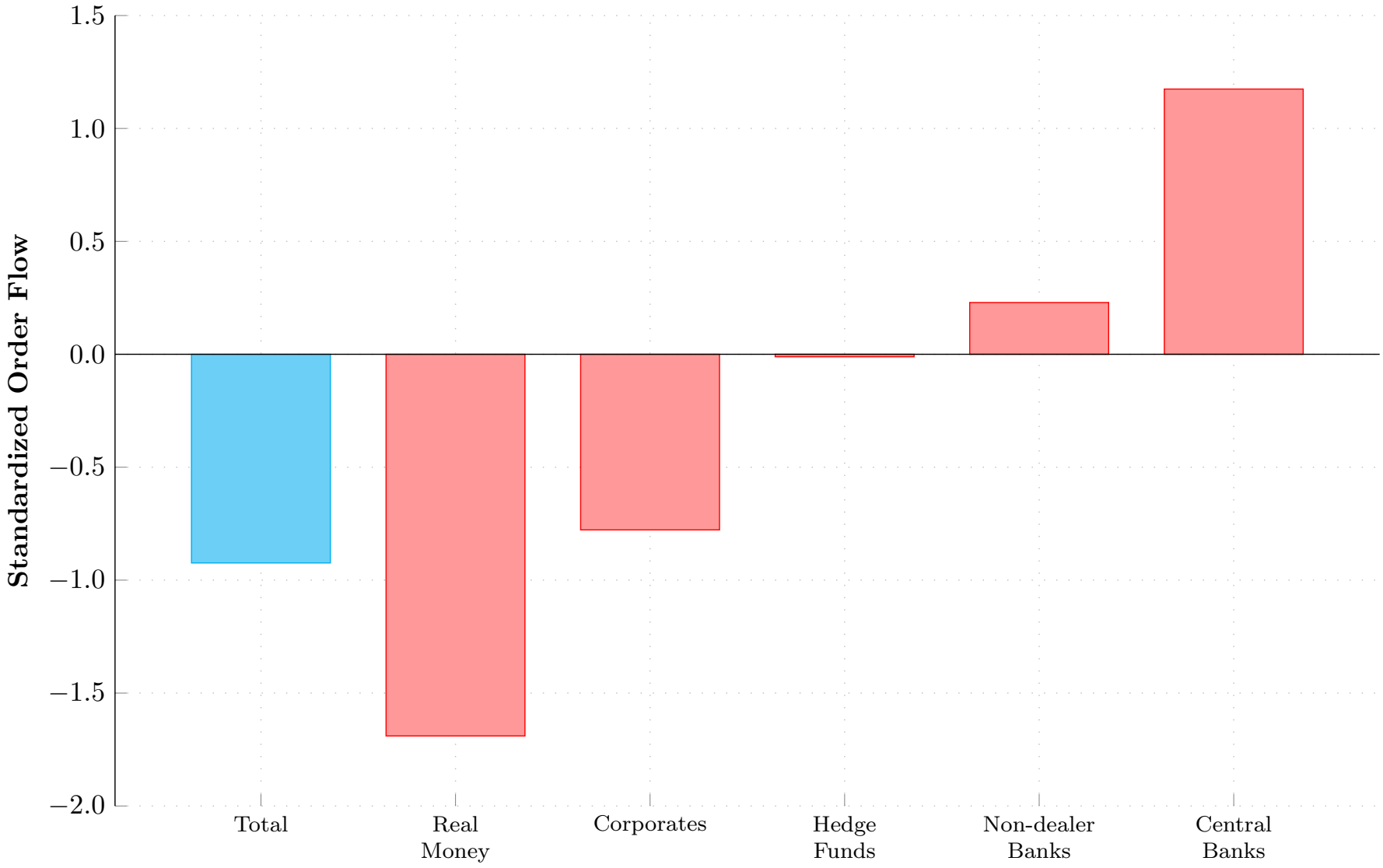


The UK Leverage Ratio Framework

Spread between **treated** (UK banks) and **untreated** (subsidiaries of foreign banks)



Who is Doing What?

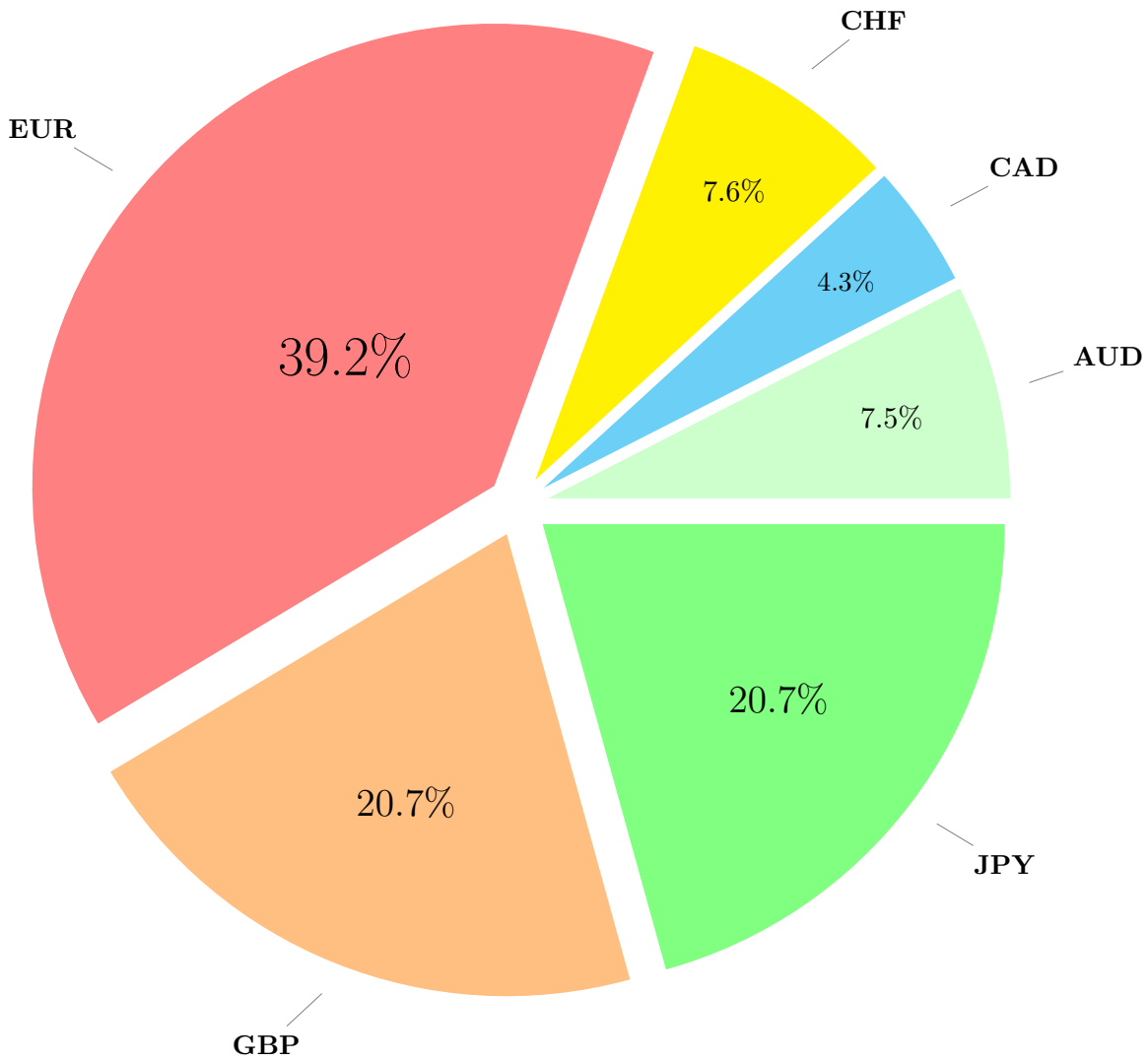


Conclusions

- **Balance sheet costs are related to currency mispricing**
  - ✓ We use a confidential and highly granular transaction-level dataset,
  - ✓ When leverage ratio ↑, future absolute CIP deviations ↑,
  - ✓ We control for both observable and unobservable factors.
- **Evidence of causal relationship based on**
  - Diff-in-Diff → introduction of the UK leverage ratio framework,
  - ✓ Event Study → US money market fund reform,
  - ✓ Event Study → ECB monetary policy announcements,
  - ✓ Panel Regression → Hedging demand proxied by order flows.
- We also examine long-term dollar basis using cross-currency swaps
  - CIP deviations widen in response to an increase in capital ratio.

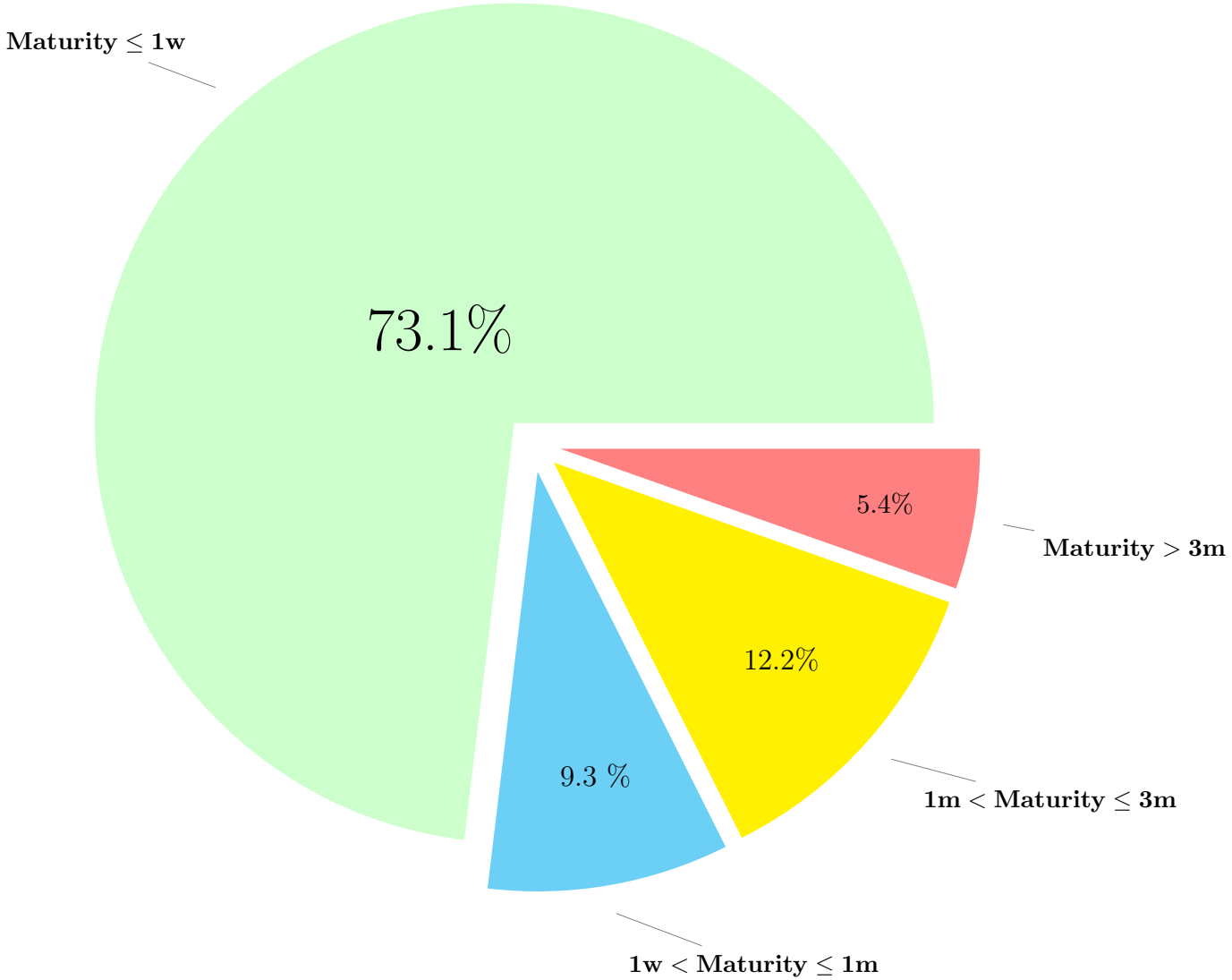
Appendix

Market Share by Currency



Go back

Market Share by Maturity



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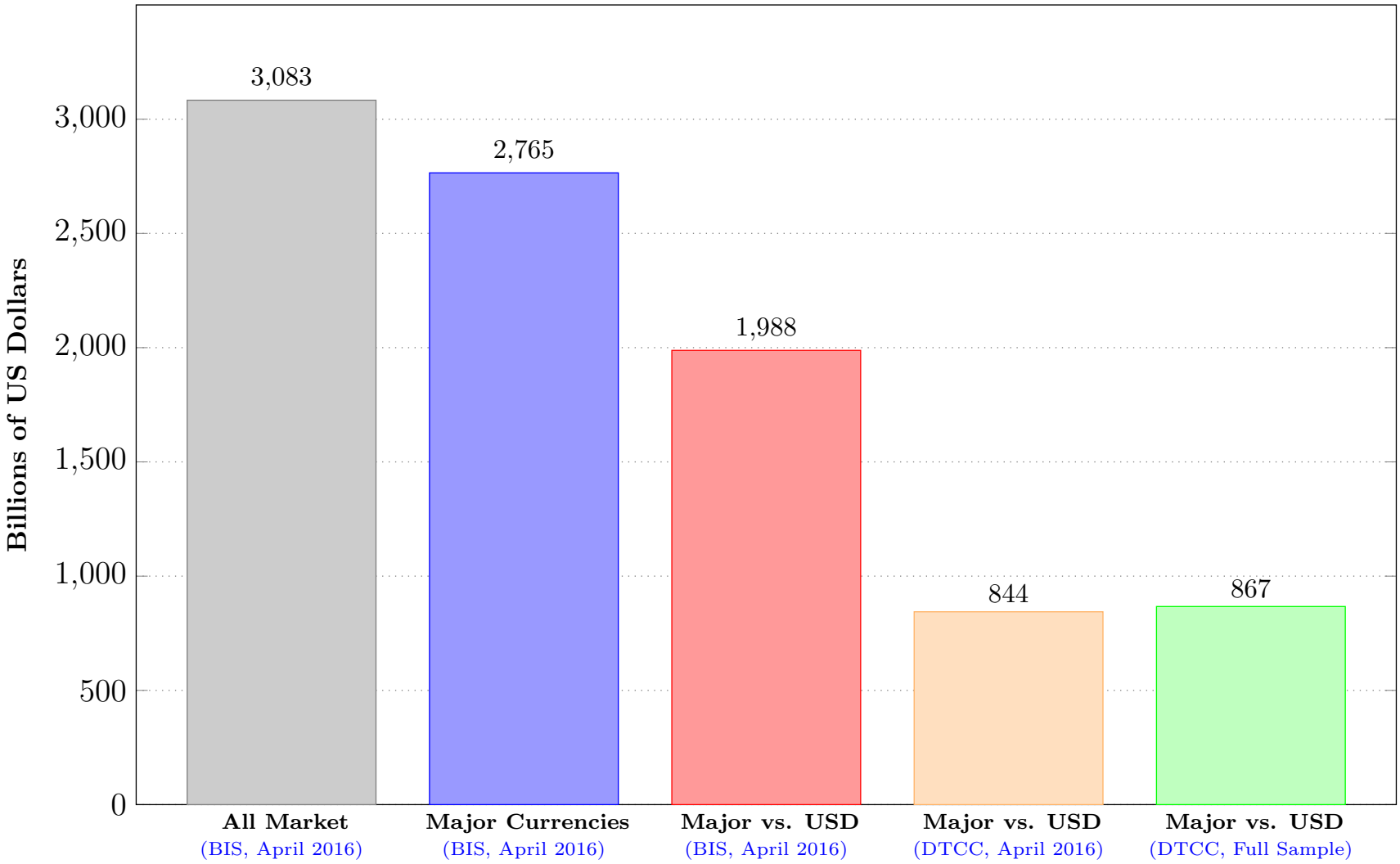
Average Daily Turnover

Comparison with 2016 BIS Triennial Survey Statistics



Go back

CIP Deviations: Summary Statistics

	LIBOR		OIS		Contract-level	
Panel A: 1-week Dollar Basis						
EUR	−32.75	(38.72)	−39.23	(48.11)	−35.27	(75.00)
GBP	−21.77	(28.95)	−21.82	(36.99)	−18.27	(99.62)
JPY	−49.86	(57.61)	−54.80	(66.47)	−49.57	(96.93)
Panel B: 1-month Dollar Basis						
AUD	10.61	(15.77)	12.97	(16.14)	−7.00	(53.90)
CAD	−41.76	(13.99)	−15.48	(12.23)	−10.37	(54.97)
CHF	−51.87	(39.02)	−85.30	(41.46)	−63.08	(53.64)
EUR	−40.49	(28.74)	−46.92	(33.42)	−33.06	(38.05)
GBP	−23.17	(22.94)	−24.19	(24.32)	−13.90	(43.04)
JPY	−58.33	(39.14)	−65.73	(41.05)	−47.51	(48.33)
Panel B: 3-month Dollar Basis						
AUD	5.89	(6.53)	10.69	(18.04)	3.07	(48.19)
CAD	−27.19	(6.24)	−13.13	(9.26)	−13.00	(48.68)
CHF	−40.91	(18.68)	−80.64	(24.99)	−72.86	(42.59)
EUR	−29.74	(12.98)	−43.23	(23.36)	−37.02	(28.29)
GBP	−13.07	(11.59)	−20.36	(16.54)	−13.64	(26.45)
JPY	−46.94	(17.50)	−64.60	(25.58)	−60.69	(37.87)

Means in basis points per annum (with standard deviations in parentheses)

- ✓ LIBOR → CIP deviations based on end-of-day exchange rates and Libor rates (≈ 11.00 am London time),
- ✓ OIS → CIP deviations based on end-of-day exchange rates and OIS rates (≈ 11.00 am London time),
- ✓ TR → CIP deviations based on transaction-level forwards sync with other second-level data from Thomson Reuters.

◂ Go back

Forward Volume and Leverage Ratio

Controlling for Currency and Client Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage Ratio	−11.300***	−11.842***	−13.716***				−10.777***	−11.309***	−12.942***
	(1.706)	(1.459)	(1.419)				(1.391)	(1.147)	(0.499)
Capital Ratio				−1.871*	−1.883*	−2.310**	−0.512	−0.520	−0.762
				(1.055)	(1.008)	(0.917)	(1.044)	(1.023)	(0.955)
Bank Size		3.083	2.878		12.299	12.457		3.173	3.014
		(10.520)	(8.381)		(11.224)	(9.757)		(10.608)	(8.420)
Liquid Asset Share		−0.195	−0.204*		−0.051	−0.068		−0.203	−0.216*
		(0.156)	(0.121)		(0.178)	(0.115)		(0.151)	(0.123)
Deposit Share		−0.298***	−0.290*		−0.198	−0.181		−0.296**	−0.286*
		(0.102)	(0.168)		(0.120)	(0.220)		(0.146)	(0.167)
Δ *Bank CDS*		−0.062	−0.002		−0.038	0.026		−0.059	0.003
		(0.217)	(0.167)		(0.201)	(0.150)		(0.208)	(0.159)
Δ *Bank IVOL*		−0.159	−0.428***		−0.115	−0.389**		−0.162	−0.434***
		(0.199)	(0.153)		(0.213)	(0.165)		(0.222)	(0.158)
R^2	0.700	0.700	0.760	0.700	0.700	0.760	0.700	0.700	0.760
Obs	749,895	749,895	344,473	749,895	749,895	344,473	749,895	749,895	344,473
Dealer	Y	Y	Y	Y	Y	Y	Y	Y	Y
Currency	Y	Y	N	Y	Y	N	Y	Y	N
Client × Time	Y	Y	N	Y	Y	N	Y	Y	N
Currency × Client × Time	N	N	Y	N	N	Y	N	N	Y

Clustered standard errors by currency and time dimension

Go back

The Public Disclosure of the Leverage Ratio

Difference-in-difference Regressions: before and after 1 January 2015

	(1)	(2)	(3)	(4)
Affected Dealers × *Post Regulatory Date*	35.842*	54.591***		
	(18.995)	(13.306)		
Affected Dealers × *Post Placebo Date*			7.620	−10.545
			(25.318)	(21.446)
R^2	0.654	0.695	0.656	0.691
Obs	13,424	5,506	14,806	6,151
Dealer	Y	Y	Y	Y
Currency	Y	N	Y	N
Client×Time	Y	N	Y	N
Currency×Client×Time	N	Y	N	Y

Clustered Standard Errors (Currency dimension)

Go back

US Money Market Fund Reform

- We consider a $\pm$ 3 day window around October 14, 2016

$$A_{ij\kappa\ell,t} = \beta_1 L_{j,t-1} + \beta_2 MMF_t + \gamma MMF_t \times L_{j,t-1} + FE + \varepsilon_{ij\ell,t}$$

✓ $MMF_t \rightarrow$ dummy that equals one starting from 14 October 2016.

	(1)	(2)	(3)
MMF	4.131**	−4.731	−17.451
	(1.666)	(4.577)	(15.652)
Leverage Ratio		−1.425	
		(1.431)	
Capital Ratio			−1.218
			(1.679)
Leverage Ratio × *MMF*		2.255**	
		(0.861)	
Capital Ratio × *MMF*			1.804
			(1.294)
R^2	0.151	0.141	0.141
obs	37,537	37,537	37,537

Go back

ECB Monetary Policy Announcements

- We consider a $\pm$ 3 day window around October 14, 2016

$$\Delta B_{j,t} = \beta_1 L_{j,t-1} + \beta_2 MP_t + \gamma MPS_t \times L_{j,t-1} + FE + \varepsilon_{j,t}$$

✓ $MPS_t \rightarrow$ change in 2-year yield differential from 13:30 to 15:30 CET.

	(1)	(2)	(3)
MPS	32.951***	7.022	−18.633
	(7.965)	(7.489)	(46.886)
Leverage Ratio		0.000	
		(0.001)	
Capital Ratio			0.001
			(0.001)
Leverage Ratio × *MPS*		6.631*	
		(3.821)	
Capital Ratio × *MPS*			4.566
			(4.578)
R^2	0.106	0.117	0.118
Obs	146	146	146

Go back

Order Flow Data

- We consider a $\pm$ 3 day window around October 14, 2016

$$\Delta B_{i\ell,t} = \beta_1 L_{t-1} + \beta_2 OF_{i\ell,t} + \gamma OF_{i\ell,t} \times L_{t-1} + FE + \varepsilon_{i\ell,t}$$

✓ $OF_t \rightarrow$ weekly order flow for currency i and maturity ℓ.

	(1)	(2)	(3)
Order Flow	0.061***	−0.287	0.012
	(0.005)	(0.168)	(0.325)
Leverage Ratio		0.005	
		(0.024)	
Capital Ratio			0.002
			(0.008)
Leverage Ratio × *Order Flow*		0.084**	
		(0.041)	
Capital Ratio × *Order Flow*			0.004
			(0.025)
R^2	0.010	0.010	0.010
Obs	1,338	1,338	1,338

Go back

Dollar Basis from Cross-currency Swaps

- Long-term CIP deviations and balance-sheet costs

$$A^{xccy}_{ij\kappa\ell,t} = \beta_1 L_{j,t-1} + \beta_2 C_{j,t-1} + \beta_3 R_{j,t-1} + \gamma' X_{j,t-1} + FE + \varepsilon_{ij\kappa\ell,t}$$

✓ $R_{j,t} \rightarrow$ exogenous bank-specific capital requirement

	(1)	(2)	(3)	(4)	(5)
Leverage Ratio	4.695***		0.430		0.048
	(0.657)		(2.101)		(1.819)
Capital Ratio		3.657***	3.578***		
		(1.259)	(1.625)		
Capital Requirement				5.794***	5.788***
				(1.955)	(2.161)
Controls	Y	Y	Y	Y	Y
Obs	7,802	7,802	7,802	7,802	7,802
Dealer/Maturity/Hour	Y	Y	Y	Y	Y
Currency×Sector×Time	Y	Y	Y	Y	Y

Go back