

Dealer Risk Limits and Currency Returns

Omar Barbiero ¹ Falk Bräuning ¹ Gustavo Joaquim ² Hillary Stein ¹

¹Federal Reserve Bank of Boston

²Amazon

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How do intermediaries' constraints impact currency movements?

- ▶ Recent theories emphasize the role of financiers' risk-bearing constraints in determining currency returns
 - ▶ e.g., Gabaix and Maggiori, 2015; Itskhoki and Mukhin, 2021
- ▶ However, empirical evidence on role of risk limits is scarce, since
 - ① Limits of market intermediaries are typically not observed
 - ② Constraints are endogenous to market conditions

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This paper: achieves identification through

- ① Novel supervisory data on FX dealers' risk limits
- ② A strategy that exploits the granularity of the dealer FX market

FX Market Granularity

- ▶ We focus on the constraints of the currency trading desks of global banks
 - ▶ Our focus is on *market intermediaries*, not ultimate risk holders
- ▶ Highly concentrated dealer-centric OTC market:
 - ▶ Market shares of the top 8 dealer banks: 92% in spot transactions, 81% in forwards, 74% in FX swaps, and 92% in options¹
- ▶ Regardless of the size of the residual risk held by dealers, shocks to their risk limits have the potential to undermine their currency mediation function
- ▶ We show that movements in market-maker constraints *do* in fact impact exchange rates when there is a currency flow to be mediated

¹Survey of North American Foreign Exchange Volume Market Share, NY Fed, October 2022

Preview of Results

- ▶ Negative net demand for foreign currency + tighter risk-limit shock $\implies$
 - ▶ Larger foreign currency depreciation (33% more)
 - ▶ US dealers reduce their holdings of the foreign currency
- ▶ Tighter risk-limit shock $\implies$
 - ▶ $\uparrow$ bid-ask spreads
 - ▶ $\downarrow$ FX market turnover
 - ▶ $\uparrow$ CIP deviations

Roadmap

- ① Introduction
- ② Model
- ③ Identification
- ④ Results
- ⑤ Conclusion

Roadmap

- 1 Introduction
- 2 Model**
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Setup

- ▶ 2 periods, 2 currencies: \$, FC. (Log) FX rate, $e \equiv \log \mathcal{E}$, in FC per \$. $E(\mathcal{E}_{t+1}) = 1$
- ▶ Symmetric bid ask spread around e : $2s$
- ▶ A representative dealer bank chooses spread s and net foreign currency exposure δ

$$\max_{s, \delta} \pi = s \underbrace{\left(\overbrace{D(e+s)}^{\text{net dollar demand}} + \overbrace{F(e-s)}^{\text{financiers' absorb}} \right)}_{\text{spread income}} + \underbrace{e\delta - \frac{\gamma}{2}\delta^2}_{\text{return on FC position } \delta \text{ net of holding cost}}$$

- ▶ Market clearing: $D(e+s) = F(e-s) + \delta$

Equilibrium

- ▶ Assume linear demand and supply functions:

$$D(e + s) = a - b(e + s)$$

$$F(e - s) = \frac{1}{\Gamma}(e - s)$$

- ▶ a is a net demand shifter (e.g., shock to preference for \$)
- ▶ Γ represents constraints of non-bank financiers of Gabaix and Maggiori (2015); as in GM, relatively inelastic dollar demand: $b\Gamma > 1$

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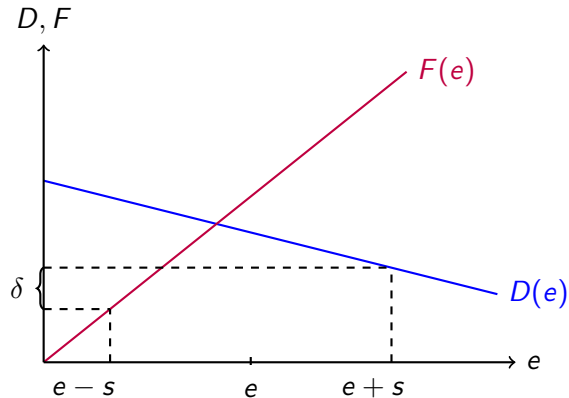
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- ▶ Γ represents constraints of non-bank financiers of Gabaix and Maggiori (2015); as in GM, relatively inelastic dollar demand: $b\Gamma > 1$
- ▶ Equilibrium solutions for e and δ depend crucially on net demand shifter a :

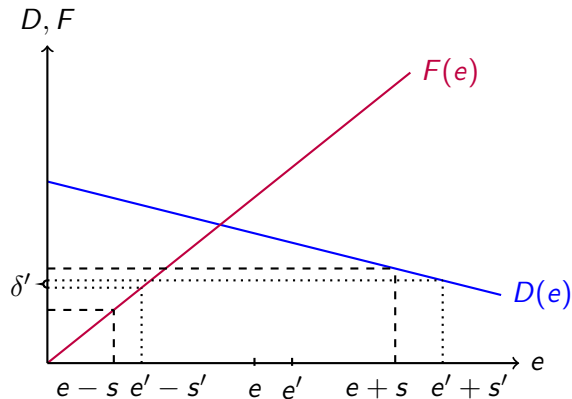
$$\delta^* = \frac{a\Gamma(3 + b\Gamma)}{A} \quad e^* = \gamma \frac{a\Gamma(3 + b\Gamma)}{A} \quad s^* = \frac{\Gamma(\Gamma + 2\gamma)}{\tilde{A}}.$$

Equilibrium with Net Positive Dollar Demand



- ▶ In response to net \$ demand shift ($a > 0$), bank charges spread and supplies dollars by holding FC ($\delta > 0$)
- ▶ $\delta > 0$ because demand more inelastic than supply: $\uparrow$ spread $\implies$ more of a decline in supply than decline in demand
- ▶ FC depreciates more than without spread-charging bank

Effect of Tighter Risk Limits (increase from γ to γ') with $a > 0$



- ▶ Bank increases spread, thereby reducing net position
- ▶ Financiers supply more dollars, but not enough to make up for the bank
- ▶ Foreign currency depreciates by more
- ▶ Key testable comparative statics:

$$\frac{\partial^2 \delta}{\partial \gamma \partial a} < 0, \quad \frac{\partial^2 e}{\partial \gamma \partial a} > 0, \quad \frac{\partial^2 s}{\partial \gamma} > 0$$

How does the equilibrium exchange rate change if we prevent the bank from either charging a spread or holding net position?

$$e^{\delta=0, s=s^*} > e^{\delta=\delta^*, s=s^*} > \underbrace{e^{\delta=0, s=0}}_{\text{Gabaix and Maggiori (2015)}} > e^{\delta=\delta^*, s=0}$$

- ▶ $\delta = 0, s = 0$: the model collapses to GM
- ▶ $\delta = \delta^*, s = 0$: lower depreciation than GM since banks act as an additional financier
- ▶ $\delta = \delta^*, s = s^*$: larger depreciation than GM because the spread limits some of the financiers' capacity for demand absorption
- ▶ $\delta = 0, s = s^*$: banks do not take any position to absorb demand, and they charge a spread, limiting financiers' willingness to buy foreign currency

Roadmap

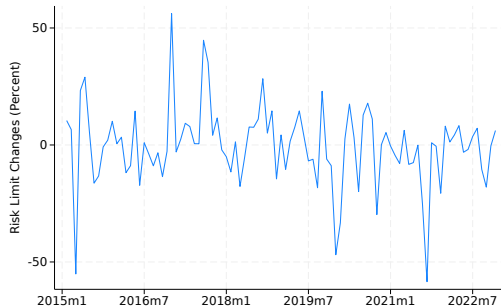
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Two key (novel) supervisory micro datasets

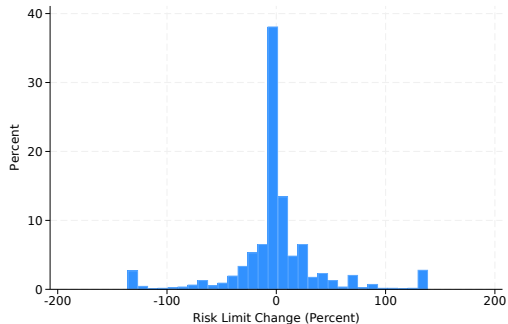
- ▶ **FR VV-1 (Volcker):** Daily desk-specific internal risk limits and usage
 - ▶ All desks of 11 largest BHCs
 - ▶ We focus on VaR limits (robust to delta/exposure limits)
 - ▶ We limit our analysis to FX desks - 167 total
- ▶ **FR Y-14Q, Schedule F (Stress testing):** Quarterly trading book net positions by currency for DFAST BHCs
- ▶ Sample period: 2015-2022

Risk Limit Changes of Trading Desks

Substantial variation and kurtosis



(a) Average Limit Change



(b) Distribution at Desk-Day Level

Notes: Panel (a) shows the monthly average of trading desks' percent changes (log difference times 100) in risk limits. Panel (b) shows the histogram of percent changes (log difference times 100) in risk limits at the desk-day level. Both data series are winsorized at the top and bottom 2.5%. *Source:* FR VV-1, authors' calculations. [► Exposures](#)

Identification of Granular Limit Shocks

- ▶ Two insights from Gabaix and Koijen (2020):
 - ① Isolate desk-level idiosyncratic risk limit changes (orthogonal to general market conditions)
 - ② Granularity of dealer-centric market $\implies$ these exogenous, idiosyncratic limit changes affect aggregate quantities
- ▶ Idiosyncratic limit changes identified from regression at the desk-day (d, τ) level:

$$\Delta \log \text{Limit}_{d,\tau} = \sum_{h=1}^{20} \gamma_h \log \text{Limit}_{d,\tau-h} + \sum_{h=1}^{20} \omega_h \text{Usage}_{d,\tau-h} + \alpha_d + \alpha_{b,\tau} + e_{d,\tau}$$

- ▶ α_d is desk fixed effects, and $\alpha_{b,\tau}$ is bank-day fixed effects
- ▶ Innovations are allowed to have common factor structure estimated by PCA

$$e_{d,\tau} = \lambda_d' f_\tau + \epsilon_{d,\tau}$$

Aggregation of Idiosyncratic Limit Innovations to Aggregate Limit Shocks

- ▶ Following granularity approach, desks' idiosyncratic limit innovations are rolled up to currency-quarter (c, t) level using (size-)weighted means:

$$\begin{aligned}\text{Limit Shock}_{b,t} &= - \underbrace{\sum_{\tau \in t} \overbrace{\sum_{d \in b} w_{d,t-1}^b \hat{\epsilon}_{d,\tau}}^{\text{Aggr. to bank-day level}}}_{\text{Aggr. to bank-quarter level}} \\ \text{Limit Shock}_{c,t} &= \underbrace{\sum_b w_{b,t-1}^c \text{Limit Shock}_{b,t}}_{\text{Aggr. to currency-quarter level}}\end{aligned}$$

- ▶ $w_{d,t-1}^b = \text{Limit}_{d,t-1} / \sum_{d \in b} \text{Limit}_{d,t-1}$ is the relative limit size of desk d (within bank) on the last day of the previous quarter
- ▶ $w_{b,t-1}^c = \text{abs}(\delta_{b,c,t-1}) / \sum_b \text{abs}(\delta_{b,c,t-1})$ is the relative net position (in absolute value) held by bank b in the aggregate net position ▶ Persistence

Key assumption: desk-level idiosyncratic risk-limit changes are exogenous to market conditions

- ▶ Anecdotally, why do risk limits change?
 - ▶ Routine changes to the VaR methodology or recalibration
 - ▶ Changes in business strategy (that is, top-down decision to reduce the activity of a set of desks)
 - ▶ Regulatory compliance
 - ▶ Trading scandals that cause rethinking of the bank's underlying risk models
- ▶ Textual analysis of banks' earnings calls:
 - 1 Summarize and rank the most important topics discussed in each bank's earnings call using a large language model (LLM)
 - 2 Group topics into 15 general topic clusters
 - 3 Compare topics and topic clusters associated with 20 largest bank-quarter risk-limit shocks to those in other calls [▶ Details](#)

Identification of Effect of Limit Shocks on Foreign Exchange Market

- ▶ Analysis at currency-quarter level for 32 currencies covering 2016q3–2022q4:

$$\Delta y_{c,t} = \beta_1 \text{LimitShock}_{c,t} + \beta_2 \text{LimitShock}_{c,t} \times \text{DemandShifter}_{c,t} \\ + \alpha_c + \alpha_t + \gamma' X_{c,t} + u_{c,t}$$

- ▶ $y_{c,t}$ is one of three outcome variables:
 - 1 log exchange rate, x100
 - 2 total net position, percent of lagged total limits
 - 3 log bid–ask spread, percent of mid point
- ▶ Demand Shifter: Innovation to sovereign CDS spread ($\uparrow$ = more dollar demand)
- ▶ Controls include 4 lags of y , the uninteracted demand shifter, and currency fixed effects $\times$ 2020q1 dummy (Covid)
- ▶ Robust standard errors are two-way clustered at currency and quarter level

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Baseline Results: Effects of Limit Shocks on FX Market

	Δ FX Rate		Δ Net Position		Δ Bid-Ask Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Directional (Baseline) Results</i>						
Limit Shock	0.045 (0.115)	0.142 (0.104)	0.130 (0.341)	-0.096 (0.371)	0.069*** (0.023)	0.073** (0.034)
Demand Shifter (CDS Innovation)		1.009*** (0.292)		-0.384 (0.442)		0.115*** (0.032)
Limit Shock $\times$ Demand Shifter		0.331** (0.137)		-0.316** (0.118)		0.000 (0.032)
Within R-squared	0.035	0.091	0.345	0.385	0.429	0.463
N	800	702	768	675	758	660
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes

► Alternative Limit Shocks

► Alternative Demand Shifter

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- ▶ The foreign currency depreciates even more after a demand shock when banks' risk limits become tighter.
- ▶ One-third larger effect

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- Conditional on a positive net dollar demand shift, banks reduce their long exposure in foreign currency after a limit shock.

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Currency FE	Yes	Yes	Yes	Yes	Yes	Yes

- ▶ Bid-ask spreads increase by 7% in response to a one-standard-deviation limit shock
- ▶ A wider bid-ask spread around the mid point allows the bank to manage its order-flow to affect its net position

Baseline Results: Effects of Limit Shocks on Flattened Variables

	Δ FX Rate		$\Delta \ln$ Net Position		Δ Bid-Ask Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel B: Unidirectional Results</i>						
Limit Shock	0.382*** (0.115)	0.476*** (0.136)	-0.087* (0.047)	-0.091* (0.050)		
Demand Shifter (CDS Innovation)		0.381 (0.324)		-0.090** (0.035)		
Limit Shock $\times$ Demand Shifter		0.215 (0.151)		0.008 (0.026)		
Within R-squared	0.470	0.434	0.435	0.447		
N	800	702	768	675		
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes

- ▶ LHS in (1) and (2) now absolute value of currency return
- ▶ LHS in (3) and (4) now log absolute value of net position

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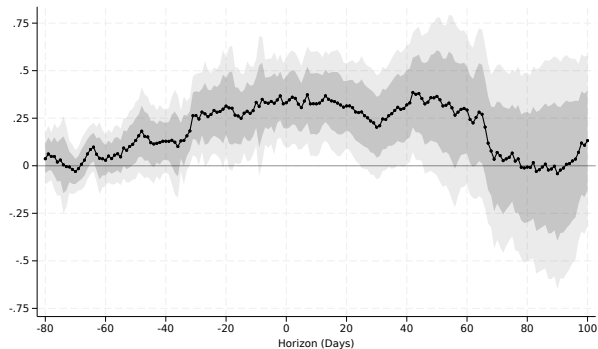
- ▶ One-standard-deviation limit shock $\implies$ exchange rates move by 38.2bps
- ▶ (= 6 percent of exchange rate standard deviation)

Baseline Results: Effects of Limit Shocks on Flattened Variables

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N	800	702	768	675		
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes

- Net positions decrease (in absolute size) by 8.7 percent

Effect of Limit Shocks on Exchange Rate is Transitory



Coefficient estimate of Limit Shock X Demand Shifter.
Day=0 indexes the last day in quarter of the shock.

- ▶ Shift the LHS variable (daily log currency return) from the last day of the quarter by τ days back or forward
- ▶ Effect on impact consistent with market segmentation and search frictions prevailing in short run
- ▶ Transitory effect suggests other dealers step in and FX market reverts back to pre-shock equilibrium [▶ Table](#)

Limit shocks trigger covered interest parity deviations

$$\Phi_{c,n,t}^{CIP} = r_{c,n,t} - r_{USD,n,t} - \frac{360}{d_{c,n,t}} (\ln F_{c,n,t} - \ln S_{c,t})$$

	Δ CIP Dev.		Δ CIP Dev.	
	(1)	(2)	(3)	(4)
Limit Shock	-1.866 (2.301)	-2.674 (3.827)	6.018*** (0.924)	7.039 (4.133)
Demand Shifter (CDS Innovation)		-72.465*** (23.953)		54.341*** (16.870)
Limit Shock $\times$ Demand Shifter		-16.158** (7.484)		2.682 (5.560)
Dep. Variable Lags	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes
Within R-squared	0.272	0.104	0.301	0.050
N	727	658	727	658

► 1-month CIP deviations widen by 6.02bps in response to a 1 std. dev. limit shock

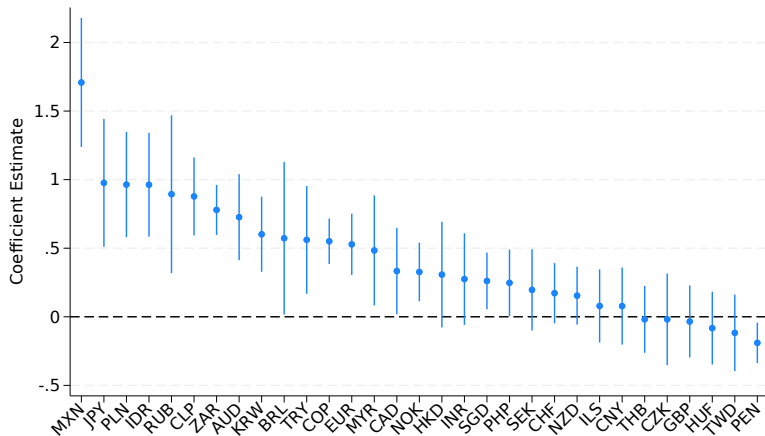
► Different tenors

Reduced Turnover/Intermediation in Response to Limit Shocks

	Currency-Time		Bank-Time	
	(1)	(2)	(3)	(4)
	$\Delta \text{ Log(Turnover)}$	$\Delta \text{ Log(Turnover)}$	$\Delta \text{ Log(Gross Notional)}$	$\Delta \text{ Margin}$
Limit Shock	-0.038** (0.016)	-0.028* (0.013)	-0.011* (0.006)	0.075* (0.038)
Dep. Variable Lags	No	No	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Currency FE	No	Yes	-	-
Bank FE	-	-	Yes	Yes
Within R-squared	0.009	0.004	0.250	0.223
N	268	268	144	144

- ▶ Currency-level turnover data from the Biannual NY Fed FX Survey
 - ▶ Based on total interdealer turnover in all FX instruments
 - ▶ The average daily turnover in our sample is \$19 billion; 3% is \$570 million
- ▶ Bank-level gross notional estimated from FR Y-9C
- ▶ Bank-level margin: total FX trading revenue relative to gross notional values

Variation in Baseline Effect (Flattened) by Currency

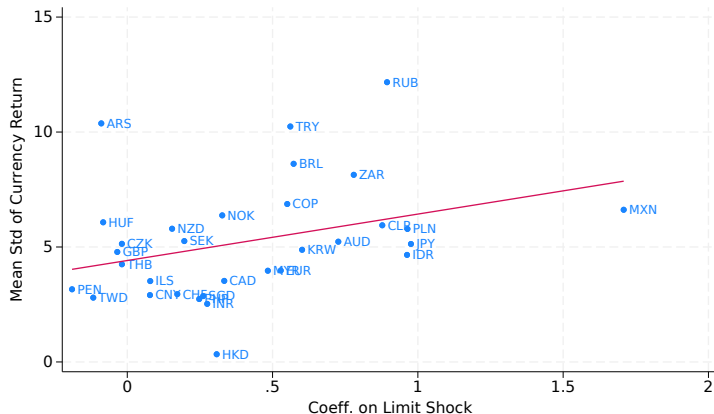


Notes: Limit Shock is standardized by currency to have mean zero and unit variance within each currency. Point estimates are shown as dots, and the bars represent 95 percent confidence intervals. Average effect (from pooled coefficient model) was 38 basis points.

More volatile currencies exhibit stronger responses to limit shocks

Note: not causally identified, but can be rationalized with model

$$\max_{s, \delta} \sum_i s_i (D_i + S_i) - e\delta - \frac{\gamma}{2} \delta' \Sigma \delta$$



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Summary and Conclusion

- ▶ Financial frictions are important to understand exchange rate movements
- ▶ We highlight the role of global banks as the central intermediaries in the highly concentrated FX market
 - ▶ Previous theoretical literature highlights constraints of financiers (ultimate holder of risk)
- ▶ Our empirical results show that shocks to their risk limits matter for exchange rate dynamics

APPENDIX

- Gabaix, Xavier, and Matteo Maggiori.** 2015. "International Liquidity and Exchange Rate Dynamics." *The Quarterly Journal of Economics*, 130(3): 1369–1420.
- Itskhoki, Oleg, and Dmitry Mukhin.** 2021. "Exchange Rate Disconnect in General Equilibrium." *Journal of Political Economy*, 129(8): 2183–2232.

US Dealers' Share in Total Gross Notional, by Currency, in Percent

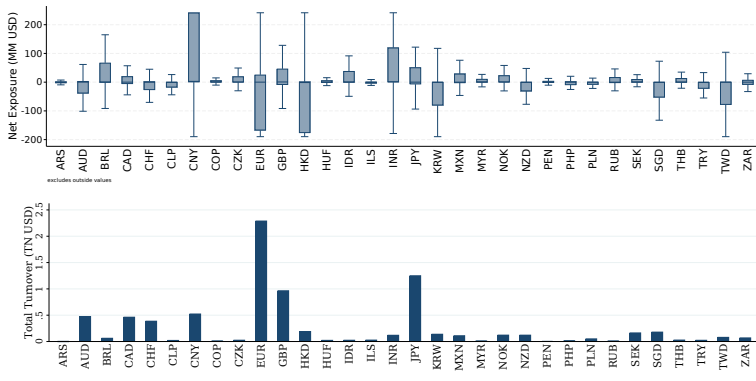
Currency/Year	2010	2013	2016	2019	2022
AUD	15.7	17.9	18.9	14.1	20.8
BRL	34.8	43.8	47.7	27.4	36.3
CAD	32.0	34.4	36.3	28.3	32.8
CHF	18.7	17.7	17.0	15.5	20.4
CNY	7.1	5.8	9.5	8.3	12.4
EUR	19.1	17.6	19.4	18.2	18.8
GBP	16.5	17.4	22.3	19.2	19.1
HUF	10.5	11.9	18.0	17.0	18.5
JPY	15.0	19.7	18.4	13.5	17.1
KRW	4.6	7.0	9.4	10.8	16.2
MXN	36.5	44.8	43.6	33.3	41.0
NOK	10.7	16.6	21.7	19.5	21.7
NZD	16.3	22.0	18.7	15.2	20.2
PLN	10.8	12.8	17.5	18.7	16.8
RUB	2.4	7.0	7.5	11.8	8.0
SEK	8.6	16.6	21.6	15.6	14.6
SGD	7.4	15.3	13.4	9.5	13.2
TRY	1.8	10.6	14.2	13.7	12.1
TWD	6.7	8.3	6.8	8.3	6.6
USD	18.2	19.2	19.2	16.6	19.6
ZAR	7.2	16.4	17.0	14.7	20.1

Variation in the change in log limits

	Δ Log Limit					
	(1)	(2)	(3)	(4)	(5)	(6)
Past Limits ($\sum_{h=1}^{20} \gamma_h$)					-0.022*** (0.001)	-0.002*** (0.000)
Past Usage ($\sum_{i=1}^{20} \omega_h$)					1.930*** (0.522)	1.943*** (0.284)
Bank FE	Yes	-	-	-	Yes	-
Desk FE	-	Yes	-	-	Yes	-
Time FE	-	-	Yes	-	Yes	-
Bank $\times$ Time FE	-	-	-	Yes	Yes	-
R-squared	0.000	0.000	0.024	0.125	0.437	0.331
N	98956	98956	98956	98956	98956	98956

Notes: Explanatory power of different models for desk-day level (log) limit changes. *Sources:* FR VV-1, FR Y-14F, authors' calculations.

Trading Desks' Net Exposure to Foreign Currencies vs. Turnover



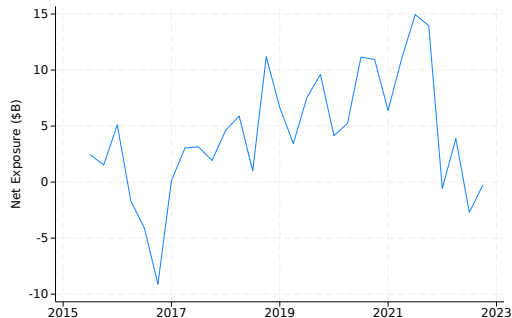
Source: FR Y-14F, BIS, authors' calculations.

Model: risk limit changes impact exchange rates, even when net exposure is small

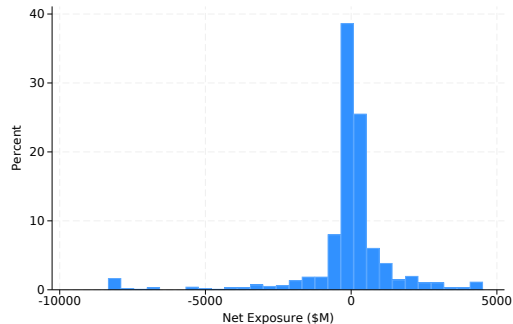
► Back

► Aggregate exposure over time and distribution

Trading Desks' Net Position in Foreign Currencies



(a) Aggregate Position



(b) Distribution at bank-quarter-currency

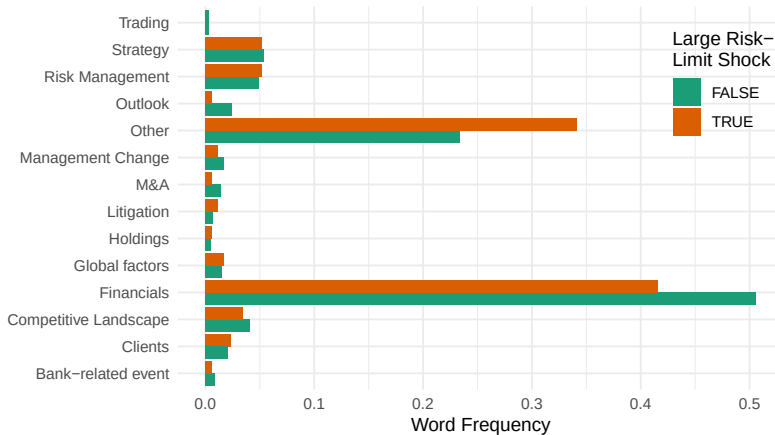
Notes: Panel (a) shows the sum of net position across all banks and currencies, for each quarter (in \$ billion). Positive values correspond to long position in foreign currency. Panel (b) shows the histogram of the net positions at the bank-currency-quarter level (in \$ million), winsorized at the top and bottom by 1 percent. We exclude Korean won exposure from panel (a) because some desks have large net short positions with an outsized effect on aggregate exposure. *Source:* FR Y-14F, BIS, authors' calculations.

Persistence of Weights

	Weights	
	(1)	(2)
Lagged Weight	0.717*** (0.008)	0.628*** (0.009)
Currency FE	No	Yes
Time FE	No	Yes
Bank FE	No	Yes
R^2	0.512	0.538
R^2 within	0.512	0.394
N	8,049	8,049

Note: Autoregressive coefficients of the weights used in the aggregation of bank-quarter limit shocks to currency-quarter limit shocks.

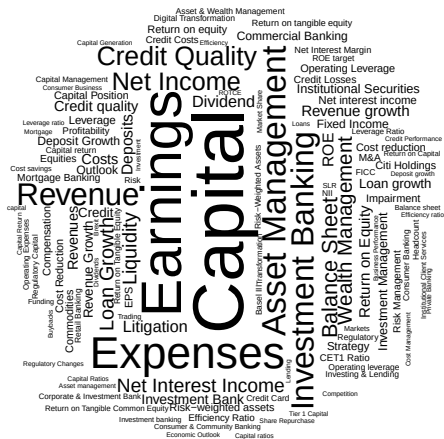
No evidence that global or bank-related events are prominent in the large-shock sample



Earning Call Topics for Large vs. Small Risk-limit Shocks

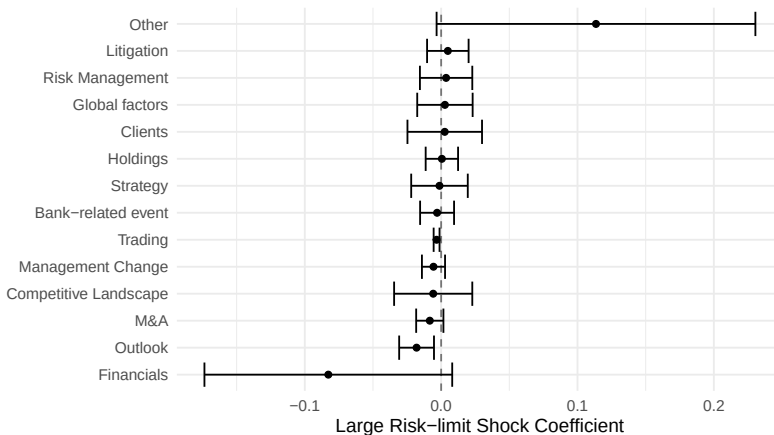


(a) Large Risk-limit Shock Sample

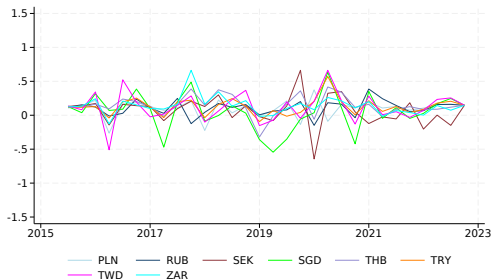
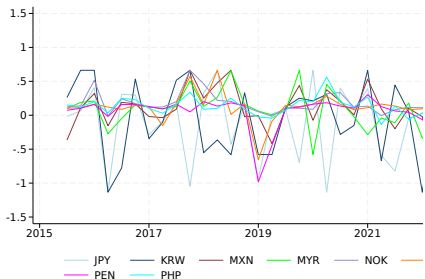
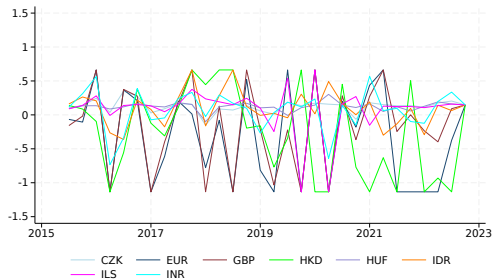
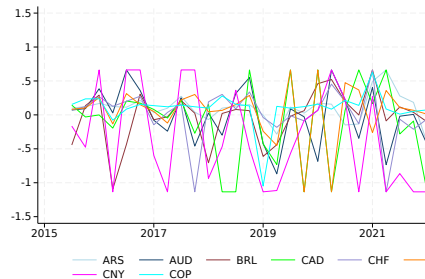


(b) All Other Earnings Calls

Mean Testing of Topic Frequencies for Large vs. Small Risk-limit Shocks



Currency-Level Limit Shocks over Time



Key Summary Statistics

	(1) Mean	(2) Std. Dev.	(3) P5	(4) P25	(5) P50	(6) P75	(7) P95	(8) N
<i>Panel A: Currency-Quarter Data</i>								
Δ FX Rate	1.08	5.94	-6.50	-2.15	0.19	3.60	10.45	960
Norm. Net Position (Pct.)	-0.10	12.02	-34.06	-2.23	0.31	3.14	25.28	928
Δ Net Position	-0.01	8.08	-10.95	-2.02	0	2.18	9.76	896
Bid-Ask Spread (Pct.)	0.25	0.48	0.01	0.04	0.12	0.27	0.80	959
Δ Bid-Ask Spread	0.05	1.06	-1.70	-0.57	0.02	0.69	1.81	904
Limit Shock (Pct.)	0.03	0.39	-1.12	-0.03	0.12	0.20	0.66	960
Limit Change (Pct.)	0.01	0.94	-0.32	-0.04	-0.02	0.02	0.51	960
Demand Shifter (CDS Innovation)	0	0.26	-0.34	-0.13	-0.01	0.08	0.43	731
Demand Shifter (Vola Innovation)	0	0.23	-0.31	-0.14	-0.03	0.09	0.40	832
CIP Deviation 1m (B.P.)	11.26	302.06	-162.41	-1.16	20.54	60.55	262.98	888
Δ Log(Turnover)	0.01	0.38	-0.39	-0.12	0.02	0.18	0.48	268
<i>Panel B: Bank-Quarter Data</i>								
Δ Log(Gross Notional)	0	0.23	-0.29	-0.08	0.01	0.11	0.30	256
Δ Margin	-0.16	6.84	-4.18	-0.32	0.09	0.31	1.92	198

Alternative Limit Shocks

	Limit Shock: 3 Factors			Limit Shock: Raw Changes		
	(1) Δ FX Rate	(2) Δ Net Position	(3) Δ Bid-Ask Spread	(4) Δ FX Rate	(5) Δ Net Position	(6) Δ Bid-Ask Spread
Limit Shock	0.059 (0.119)	0.044 (0.322)	0.068 (0.043)	0.134 (0.122)	0.149 (0.496)	-0.054* (0.031)
Demand Shifter (CDS Innovation)	1.034*** (0.286)	-0.407 (0.439)	0.115*** (0.032)	1.065*** (0.275)	-0.556 (0.482)	0.118*** (0.032)
Limit Shock $\times$ Demand Shifter	0.329** (0.125)	-0.445* (0.226)	-0.020 (0.034)	0.009 (0.089)	-0.263 (0.519)	0.008 (0.018)
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.090	0.386	0.462	0.088	0.385	0.460
N	702	675	660	702	675	660

Alternative Demand Shifter: Implied Volatility

	Δ FX Rate			Δ Net Position			Δ Bid-Ask Spread		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Limit Shock	0.045 (0.115)	-0.070 (0.111)	0.009 (0.090)	0.130 (0.341)	0.141 (0.358)	-0.055 (0.352)	0.069*** (0.023)	0.058** (0.025)	0.067** (0.026)
Demand Shifter (Vola. Innovation)		1.357*** (0.400)	1.321*** (0.390)		-0.120 (0.404)	-0.032 (0.372)		0.133*** (0.036)	0.128*** (0.034)
Limit Shock $\times$ Demand Shifter			0.333*** (0.045)			-0.768*** (0.253)			0.043*** (0.015)
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.035	0.111	0.116	0.345	0.345	0.352	0.429	0.447	0.448
N	800	800	800	768	768	768	758	758	758

Response of Bank-currency-level Positions to Other Banks' Limit Shocks

	$\Delta \text{ Log Abs Exposure}$		
	(1)	(2)	(3)
Limit Shock	0.143** (0.054)	0.159*** (0.050)	0.179*** (0.064)
Currency*Time FE	Yes	Yes	Yes
Currency*Bank FE	No	Yes	Yes
Bank*Time FE	No	No	Yes
Within R-squared	0.829	0.132	0.121
N	11547	11500	11500

Notes: The dependent variable is the change in the logarithm of the absolute value of the delta position, at the bank-currency-quarter level. The key independent variable is Limit Shock, which is, as before, the aggregated idiosyncratic limit changes, but now aggregated only for other banks, excluding the bank under consideration. The regression includes four quarterly lags of the dependent variable. Standard errors are two-way clustered at the currency and quarter levels.

Effect of Limit Shocks on CIP Deviations of Different Tenors

	Δ CIP Dev. 1m		Δ CIP Dev. 3m		Δ CIP Dev. 6m	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: CIP Deviations</i>						
Limit Shock	-1.866 (2.301)	-2.674 (3.827)	-2.329 (3.558)	-2.801 (3.530)	-0.261 (4.226)	-0.388 (4.664)
Demand Shifter (CDS Innovation)		-72.465*** (23.953)		-54.830*** (18.368)		-52.056*** (13.042)
Limit Shock $\times$ Demand Shifter		-16.158** (7.484)		-10.539** (4.809)		-9.490** (3.508)
Within R-squared	0.272	0.104	0.253	0.076	0.191	0.120
N	727	658	714	645	628	563
<i>Panel B: Absolute Value of CIP Deviations</i>						
Limit Shock	6.018*** (0.924)	7.039 (4.133)	5.584* (3.020)	6.698 (4.955)	6.212* (3.251)	7.074** (3.197)
Demand Shifter (CDS Innovation)		54.341*** (16.870)		38.358*** (12.780)		33.883*** (9.991)
Limit Shock $\times$ Demand Shifter		2.682 (5.560)		4.311 (4.590)		4.797 (4.061)
Within R-squared	0.301	0.050	0.267	0.074	0.210	0.143
N	727	658	714	645	628	563
Dep. Variable Lags	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes