Topography of the FX Derivatives Market: A View from London

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The views expressed here do not necessarily reflect the position of the Bank of England or Federal Reserve System.

Motivation

- 70% of global FX turnover ($5.4 trillion daily in 2022) occurs in derivatives markets, vs. only 30% in spot markets. [BIS, 2024]
  - Key for exchange rate dynamics, trade and financial flows, policy transmission and spillovers.

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- This paper: Exploit over 100 million transactions to construct and analyze daily firm-level net FX derivatives exposures for all 16000 participants in the largest FX market in the world—London ($\sim$ 40% of global turnover).
  - Net exposures at firm-level crucial since they determine firms' profits/losses from FX derivatives and so their FX derivatives demand, which matter for exchange rates.

Key Questions

- What are the motives behind different firms' FX derivatives use?
  - asset managers, dealer & non-dealer banks, market makers, hedge funds, non-financials.
  - Who is mostly hedging? Mostly speculating? Who is providing the liquidity?
  - Market concentration? Within-sector heterogeneity?
- How do different firms adjust their net FX derivatives exposures to changes in interest rates, exchange rates, and macroeconomic news?
  - How does the market equilibrate in the face of speculative currency flows?
- How does this heterogeneity in firm demand affect exchange rates?
  - Which sectors net FX derivatives exposures most-strongly co-move with exchange rates, both unconditionally and conditional on important aggregate shocks?
    - monetary policy surprises in major jurisdictions
    - US credit spread innovations from macro news surprises

Data

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- UK segment of the European Market Infrastructure Regulation (EMIR) Trade Repository (TR) dataset on over-the-counter (OTC) FX derivatives transactions.
  - All FX derivatives (swaps, forwards, futures) transactions that have either a UK firm as a counterparty or an EU firm as a counterparty, if transaction occurs in UK/includes GBP.

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- Using over 100 million transactions (second-by-second), we construct daily firm-level FX derivative net exposures for 16000 firms.
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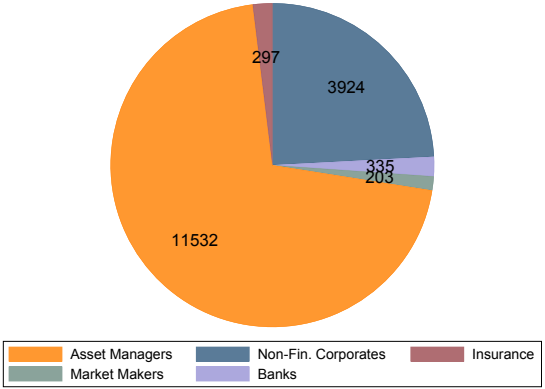
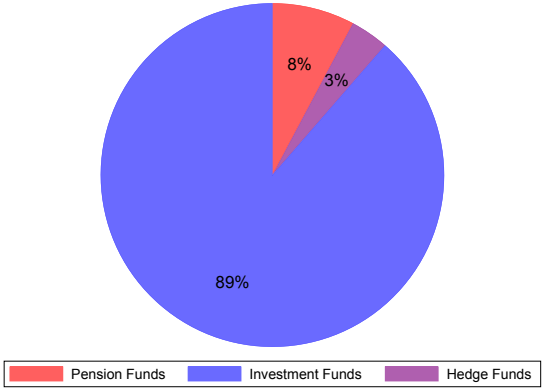
- To facilitate analysis, we manually classify firms into 5 (8) sectors.
  - (i) asset managers (hedge funds, investment funds and pension funds); (ii) non-financial corporates; (iii) insurers; (iv) (non-bank) market makers; and (v) banks (dealer and non-dealer).

Firms Trading FX Derivatives by Sector

(a) Sectoral Breakdown



(b) Asset Manager Breakdown



Note. Number of unique firms trading FX derivatives, by sector. Firms included are those in the DTCC and UnaVista trade repositories between January 1 2015 and December 31 2020.

Motives & FX Derivatives Exposures

Speculative and Hedging Components of Net FX Derivative Exposure

- Consider a UK firm i that chooses its (net) FX derivatives exposure $N_{0,1}^{i,\{USD,GBP\}}$ by solving a two-period ($t = \{0, 1\}$) optimization problem:

$$\max_{N_{0,1}^{i,\{USD,GBP\}}} E_0^i \left(\pi_{0,1}^{i,FX,deriv} + X_1^{i,H} \right) - \frac{\rho}{2} Var_0^i \left(\pi_{0,1}^{i,FX,deriv} + X_1^{i,H} \right),$$

$X_1^{i,H}$ is i's non-FX derivatives profits, $\pi_{0,1}^{i,FX,deriv} = (S_1^{GBP/USD} - F_{0,1}^{i,GBP/USD}) N_{0,1}^{i,\{USD,GBP\}}$

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- *Balance* between speculative and hedging demand is first order for exchange rates

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- Key distinction: Hedging demand often one-directional, speculative demand changes sign.

Net Currency-Cross and Currency *Stock* Exposures

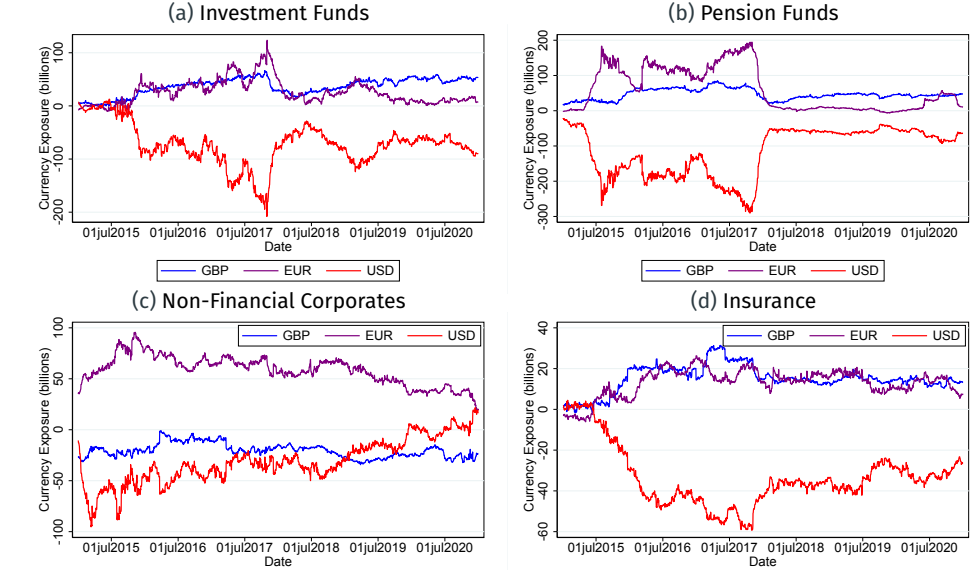
- Firm i's net currency-cross derivatives *stock* exposure to the $\{m,k\}$ cross nets exposures from all non-expired contracts:

$$Stock_t^{i,\{m,k\}} = \sum_{\mu:\tau^{\mu}_{start} \leq t < \tau^{\mu}_{end}} N^{\mu,i,\{m,k\}}_{\tau^{\mu}_{start},\tau^{\mu}_{end}},$$

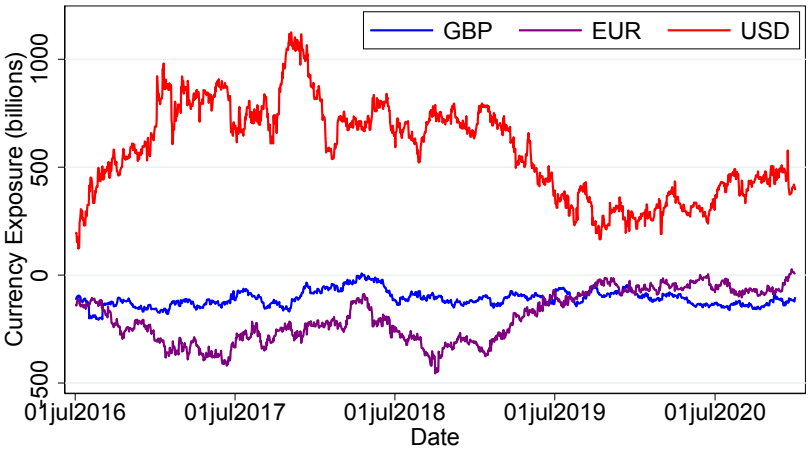
- Firm i's net currency l *stock* exposure: $Stock_t^{i,l} = \sum_k Stock_t^{i,\{l,k\}} + \sum_m \widetilde{Stock}_t^{i,\{m,l\}}$
  nets out cross exposures in which i receives and pays currency l across all crosses.

- Sector S's net currency-cross $\{m,k\}$ or currency l *stock* exposure: sum over $i \in S$

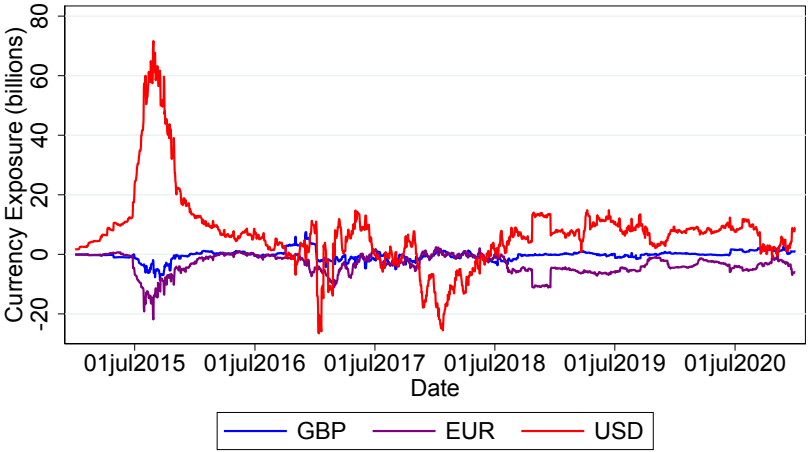
Largest Client Sectors: Persistent Net-Short USD Stock Exposures



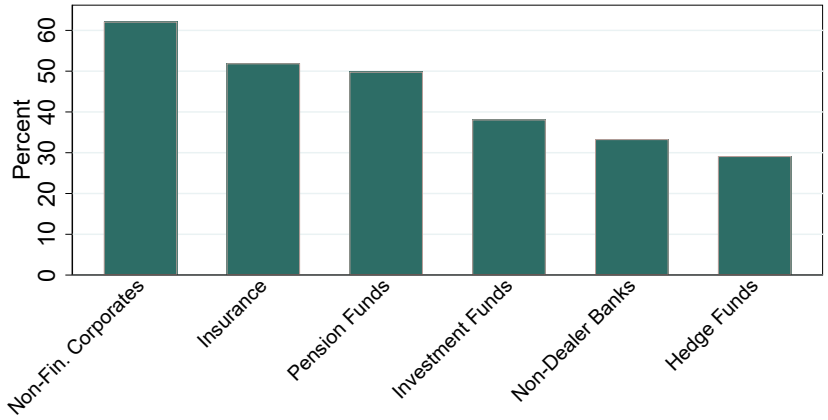
Dealer Bank Sectors Persistent Net-long USD Stock Exposure



Hedge Fund Sector's USD Net Stock Exposures Changing Sign

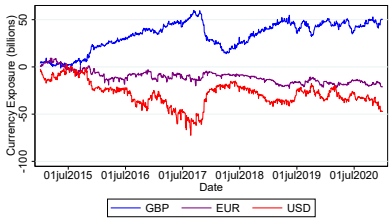


% of Clients w/ Persistent ($> 95\%$) One-Directional USD Exposures

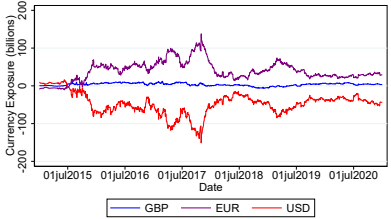


UK vs. EU Investment and Pension Fund Net Stock Exposures

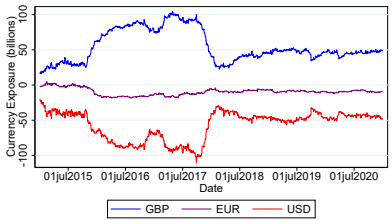
(a) UK Investment Funds



(b) EU Investment Funds



(c) UK Pension Funds



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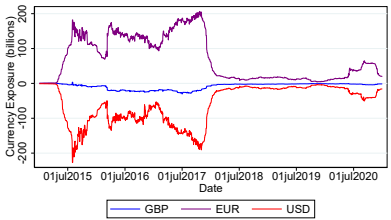
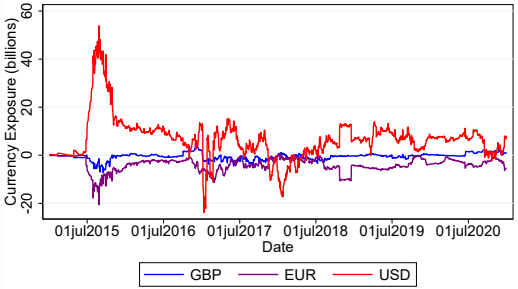
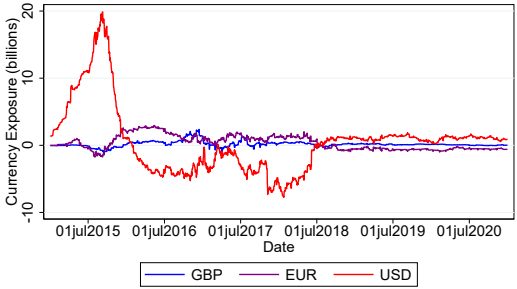


Non-EU vs. EU Hedge Fund Net Stock Exposures

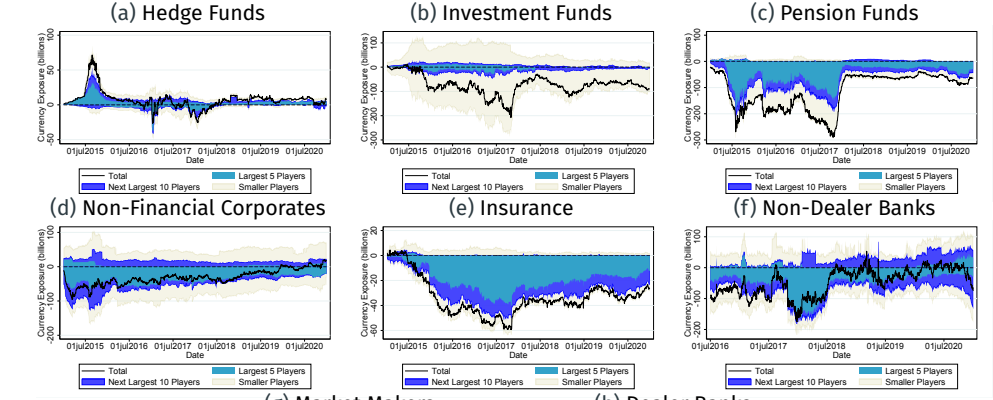
(a) Non-EU Hedge Funds



(b) EU Hedge Funds



Heterogeneity and Concentration in Sectoral Net USD Exposures



Net Exposures Adjustment

Carry Trade: Interest Differentials and USD-EUR Net Exposure

$$\frac{Stock_{t+h}^{i,\{m,k\}} - Stock_{t-1}^{i,\{m,k\}}}{\overline{|Stock^{i,\{m,k\}}|}} = \alpha_i^h + \beta^h[(r_{t+h}^m - r_{t+h}^k) - (r_{t-1}^m - r_{t-1}^k)] + u_{i,t}^h$$

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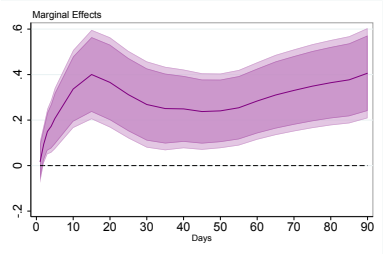
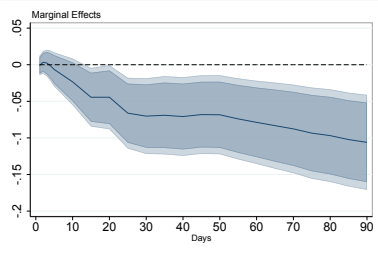
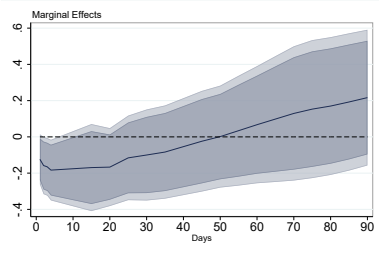


(b) Non-Financial Corporates



(c) Dealer Banks



- $\beta_1 > 0$ consistent with speculation, $\beta_1 < 0$ accommodates speculation, could be hedging.

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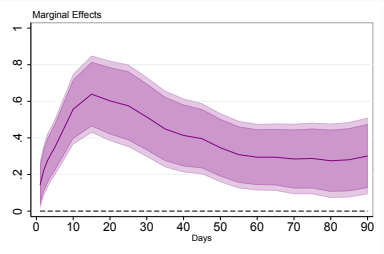

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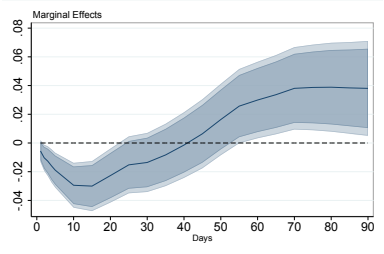

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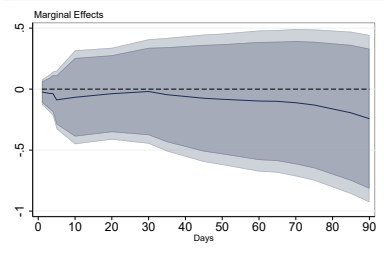

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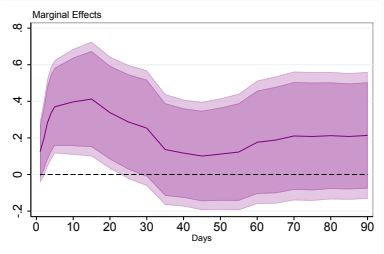

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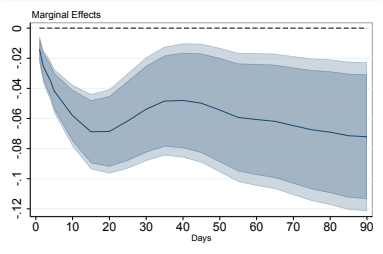

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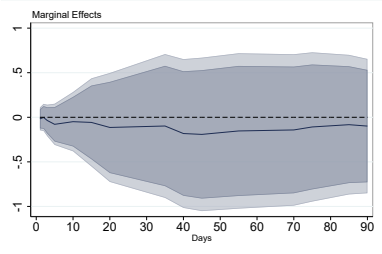

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Momentum: Exchange Rate Changes and USD-EUR Net Exposure

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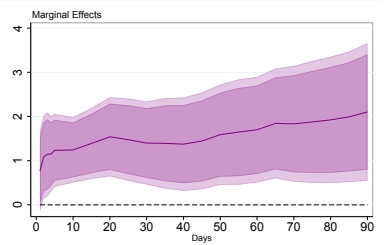

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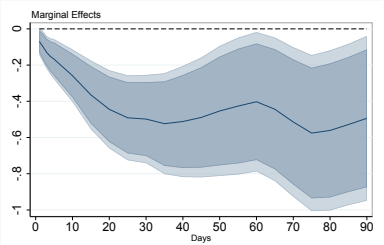

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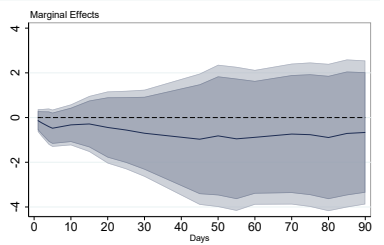

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Exchange Rate Macro News and USD-EUR Net Exposure

$$\frac{Stock_{t+h}^{i,\{m,k\}} - Stock_{t-1}^{i,\{m,k\}}}{|\overline{Stock^{i,\{m,k\}}}|} = \alpha_i^h + \beta^h[\boldsymbol{FXMacroNews_{t-1,t+h}^{m,k}}] + u_{i,t}^h$$

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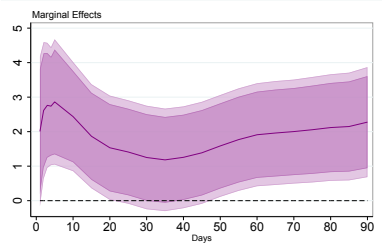

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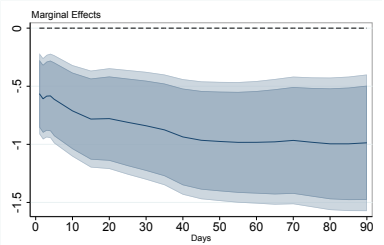

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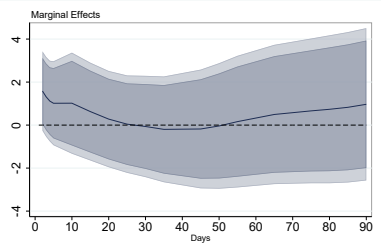

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Net Derivatives Exposures & Exchange Rates

Exchange Rates & Clients' FX Exposures: Unconditional Co-Movement

$$\Delta s_t^{k/m} = \alpha + \sum_{s \in S} \beta^s \frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|} + \boldsymbol{\gamma}' \boldsymbol{X}_t + u_t,$$

where $\frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|}$ is change in sector-level stock exposure and $\boldsymbol{X} = \{\Delta CIP^{\{m,k\}}, \Delta \log VIX, \Delta(r^m - r^k), \Delta s^{k/m}\}$

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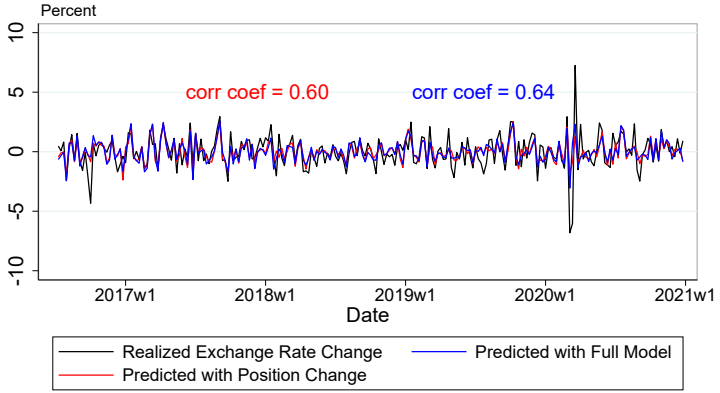
$$\Delta s_t^{k/m} = \alpha + \sum_{s \in S} \beta^s \frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|} + \boldsymbol{\gamma}' \boldsymbol{X}_t + u_t,$$

Fitting Weekly USD/GBP ER Changes with Net Derivatives Exposures



- Hedge funds' & non-financials' positions most associated with exchange rates.

▸ Reg. Table

Aggregate Shocks, Conditional Net Exposures & Exchange Rates

$$s_{t+h}^{k/m} - s_{t-1}^{k/m} = \alpha + \beta^s \frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|} + \boldsymbol{\gamma}' \boldsymbol{X}_{t-1} + u_t,$$

where we instrument $\frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|}$ with 2 important aggregate shocks for exchange rates:

Aggregate Shocks, Conditional Net Exposures & Exchange Rates

$$s_{t+h}^{k/m} - s_{t-1}^{k/m} = \alpha + \beta^s \frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|} + \boldsymbol{\gamma}' \boldsymbol{X}_{t-1} + u_t,$$

where we instrument $\frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|}$ with 2 important aggregate shocks for exchange rates:

Monetary policy shocks in major jurisdictions (first stage):

$$\Delta \mathbf{S}_t^{s,\{m,k\}} / \overline{|\mathbf{S}^{s,\{m,k\}}|} = \sigma_0 + \sigma^{s,m} \varepsilon_t^m + \sigma^{s,k} \varepsilon_t^k + \boldsymbol{\delta}' \boldsymbol{X}_{t-1} + u_t$$

Aggregate Shocks, Conditional Net Exposures & Exchange Rates

$$s_{t+h}^{k/m} - s_{t-1}^{k/m} = \alpha + \beta^s \frac{\Delta \mathbf{S}_t^{s,\{m,k\}}}{|\mathbf{S}^{s,\{m,k\}}|} + \boldsymbol{\gamma}^{'} \boldsymbol{X}_{t-1} + u_t,$$

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US credit spread innovations from macro news (first stage):

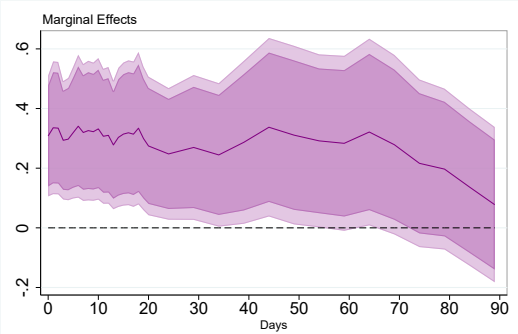
$$\Delta \mathbf{S}_t^{s,\{USD,k\}} / \overline{|\mathbf{S}^{s,\{USD,k\}}|} = \sigma_0 + \sigma^{s,CS} \boldsymbol{CSMacroNews_t^{US}} + \boldsymbol{\delta}^{'} \boldsymbol{X}_{t-1} + u_t,$$

Aggregate Shocks and Net Derivative Exposures: First-Stage Results

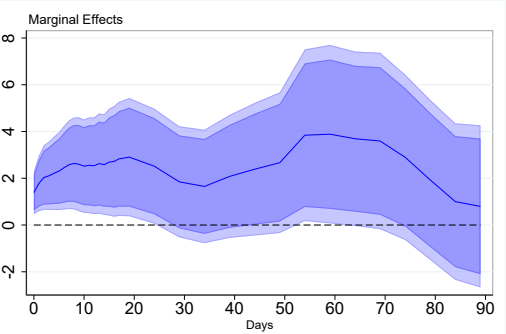
	$\Delta \mathbf{S}_t^{s,\{m,k\}} / \lvert\overline{\mathbf{S}^{s,\{m,k\}}}\rvert$	
	Hedge Funds	Investment Funds
ε_t^m	.424**	
	(.181)	
ε_t^k	-.461*	
	(.247)	
$CSMacroNews_t^{m=US}$		.016***
		(.005)
Controls	Yes	Yes
F-Stat	13.67	26.66
# Panels	4	2
N	342	4022

Hedge Funds & Monetary Policy; Investment Funds & Credit Risk

(a) Hedge Funds & Monetary Policy Surprises



(b) Investment Funds & Credit Risk News Surprises



- Monetary tightening shock in $m \rightarrow$ hedge funds more long m vs. $k \rightarrow m$ appreciation vs. k
- News raises US credit spreads $\rightarrow$ investment funds less short USD $\rightarrow$ USD appreciates

Conclusion: New Facts about World's Largest FX Market

- Motives: Investment & pension funds, non-financials & insurers mostly hedge; Dealer banks provide liquidity; and Hedge funds mostly speculate with FX derivatives
- Adjustment: Hedge funds adjust exposures in line with classic FX investment strategies. Hedgers, especially non-financials, accomodate this. Dealers remain neutral and 'toll-take'.
- Transmission: Hedge funds help transmit monetary policy shocks to exchange rates; Investment funds contribute to USD appreciations when credit risk rises.
- Overall: Range of heterogeneous firms, guided by distinct objectives, interact to determine exchange rates. Suggests need to move away from 'arbitrageur-noise trader' models.

Appendix

Exchange Rate Changes and Sectors' FX Derivatives Positions

	$\Delta s_t^{k/m}$			
	USD/GBP	EUR/USD	JPY/USD	EUR/GBP
$\Delta \mathbf{S}_t^{s,\{m,k\}} / \lvert\overline{\mathbf{S}^{s,\{m,k\}}}\rvert$				
Hedge Funds	1.20***	1.36***	1.55***	-.11
	(.44)	(.52)	(.58)	(.30)
Investment Funds	3.13	6.03***	1.54	6.29
	(6.06)	(2.25)	(1.16)	(3.94)
Pension Funds	-1.63	3.04	-.42**	.49
	(1.63)	(2.05)	(.20)	(1.63)
Non-Fin. Corporates	-44.90***	-8.58***	-.51	-23.84***
	(5.80)	(2.70)	(1.31)	(3.17)
Insurers	-1.66	-.02	.14	2.38***
	(2.49)	(.92)	(.14)	(.85)
Non-Dealer Banks	-.23	-.37	.50	-.38*
	(0.86)	(0.71)	(.34)	(.21)
Market Makers	.33**	-.57**	-.08	.02
	(.15)	(.27)	(.09)	(.19)
R^2	.42	.25	.45	.41
N	233	233	233	233

Notes: Regression results from fitting exchange rates with derivatives positions. Lags of derivatives positions and controls are suppressed for compactness. $***$ denotes $p < 0.01$, $**$ $p < 0.05$ and $*$ $p < 0.10$ based on newey-west standard errors with 12 lags.

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