



## 1. Introduction

Despite being the largest segment of foreign exchange (FX) trading, little is known about the market microstructure of FX swaps. This paper provides the first global study of FX swap liquidity, documenting it across tenors and currency pairs. As compared to the regular spot segment, FX swaps are more dollar dominated and trade at a lower frequency, albeit in larger volumes. Liquidity deteriorates around reporting dates when dealers are particularly constrained. Surprisingly, we show that this does not happen due to a dealer pullback in intermediation but rather due to an increase in price dispersion.

## 2. Data and methods

We measure liquidity by studying price impact: how much prices are affected by order flow. We leverage the realised Amihud measure of Rinaldo & Santucci de Magistris (2022) which is a ratio of the realised power variation (RPV) to the underlying trade volume. RPV is the sum of absolute intraday returns and can be seen as a measure of volatility stemming from price disagreement (heterogeneous reserve prices). In the context of FX swaps, we use swap points - the difference between the forward rate and the spot rate - as our variable of interest. Given spot and forward rates of  $S$  and  $F$ , for a given currency pair  $x|y$  with tenor  $m$ , we define the RPV of day  $t$  composed of  $I$  sub-intervals as:

$$RPV_t^{(x|y),m} = \sum_{i=1}^I |F_{i,t}^{(x|y),m} - S_{i,t}^{(x|y),m}| \quad (1)$$

which we thus use as the numerator in our measure:

$$A_t^{(x|y),m} \triangleq \frac{RPV_t^{(x|y),m}}{V_t^{(x|y),m}} \quad (2)$$

For robustness checks, we also use the bid-ask spread as an alternative measure. We use 5-minute interval intraday pricing data from Bloomberg, which is a mix of quote/execution prices. For volume, we use global data from Continuous Linked Settlement which represents up to 50% of the market as compared with BIS Triennial surveys.

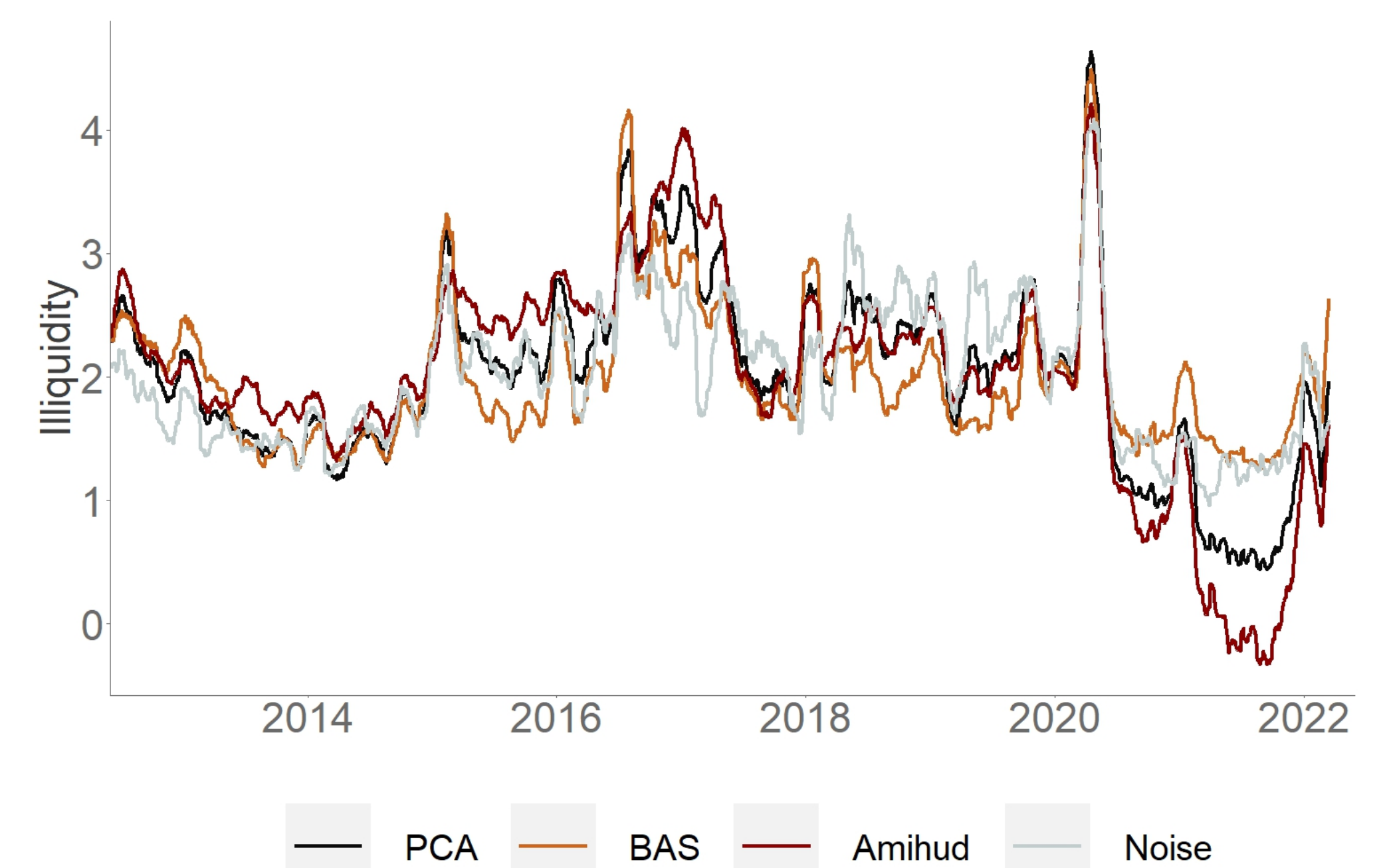
## 3. Stylised facts

A number of intermediary findings can be made:

- FX swaps trade at a far lower frequency than the spot segment - but in much larger trade sizes. E.g. the daily swap volume in EURUSD is 265 B versus just 130 B in spot, but 111'586 spot trades occur on average versus just 2'179 in swap, meaning that the trade sizes were 1.2 and 123.3 M respectively !
- FX swap markets are even more dollar-dominated than the spot segment: while ~85% of spot transactions include the dollar, 95% of FX swaps do so.
- Significantly, we find a strong ~50% correlation between RPV and volume at the weekly frequency, which suggests that order flow is indeed impacting prices (Karpoff, 1987).
- Realised Amihud has a 56% correlation with the bid-ask spread, which is lower than what we observe in spot: 91%.

## 4. Global illiquidity index

The figure here shows our global illiquidity index, which is the first component of a principal components analysis across tenors and currency pairs, using realised Amihud, the bid-ask spread, and triangular mispricing. Swap liquidity displays frequent sharp negative episodes. Illiquidity was most pronounced around 2016, likely resulting from the implementation of the U.S. money market reform. The largest persistent spike occurred during the onset of the Covid-19 crisis, but died down upon the implementation of central bank swap lines.



## 5. Liquidity and market efficiency at regulatory quarter-ends

FX swap prices are prone to pronounced distortions around bank reporting dates (Du, Tepper & Verdelhan, 2018) due to the implementation of Basel III regulations. That is, we observe breakdowns in covered interest parity (CIP), whereby the below no-arbitrage principle no longer holds:

$$F_{t,t+1} = S_t \cdot \left( \frac{1 + i_{t,t+1}^q}{1 + i_{t,t+1}^b} \right) \quad (3)$$

where  $i^b$  and  $i^q$  refer to the base and quote currencies' respective interest rates. As intermediaries' balance sheets are constrained by regulatory ratios, this suggests that they are forced to scale back their activity, which could result in a reduction in trading volume at quarter-ends (QE), and a dry-up of liquidity. We run the below regressions to test how liquidity evolves at QE; the independent variable is whether a swap contract crosses a QE during the 2012-2022 period.

	All tenors				Short-term tenors			
	Amihud (1)	BAS (2)	RPV (3)	Volume (4)	Amihud (5)	BAS (6)	RPV (7)	Volume (8)
Cross quarter-end	0.043*** (0.012)	0.078 (0.052)	0.108** (0.052)	0.019 (0.023)	0.141*** (0.035)	0.494*** (0.065)	0.636*** (0.075)	0.131*** (0.035)
Currency-tenor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	200'810	179'738	200'810	200'810	145'106	127'932	145'106	145'106
R <sup>2</sup>	0.0005	0.002	0.003	0.0001	0.001	0.018	0.029	0.001
Adj. R <sup>2</sup>	-0.001	0.0005	0.002	-0.001	0.001	0.017	0.029	0.0004

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

While our analysis confirms that QE episodes are indeed marked by heightened illiquidity, trading volume surprisingly remains robust throughout the QE and even rises in certain tenors. The rise in price impact instead occurs due to a relatively larger increase in RPV, suggesting heightened price dispersion and disagreement. This corroborates anecdotal evidence from dealers who explain that they must always be available for their customers; when constrained, they charge their (heterogeneous) marginal costs of intermediation. Importantly, this case emphasises that (more) volume in a market does not necessarily imply a more liquid market.

## 6. Next steps

Logical next questions would be whether illiquidity in FX swap markets can cause market inefficiencies. We can test this by analysing whether liquidity is causing breaks in triangular no-arbitrage and CIP conditions. Preliminary results show that CIP deviations spike on trading holidays, suggesting illiquidity affects the efficiency of swap markets. Furthermore, we have some work showing that QE CIP deviations worsen when illiquidity is worse.

**References:** Du, W., A. Tepper & A. Verdelhan (2018): "Deviations from covered interest rate parity," *Journal of Finance*, 73, pp. 915-57. | Karpoff, J. (1987): "The Relation between Price Changes and Trading Volume: A Survey," *Journal of Financial and Quantitative Analysis*, vol 22., No. 1. | Rinaldo A. & P. Santucci de Magistris (2022): "Liquidity in the Global Currency Market," *Journal of Financial Economics*, forthcoming.